MARCH 29, 1954

NEWS ISSUE

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Flatiron: One Turbine in Three Is a Pump . . . Page 42

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Research Examines Plated Cor

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GS W 12
UNIVERSITY MICROFILMS IN
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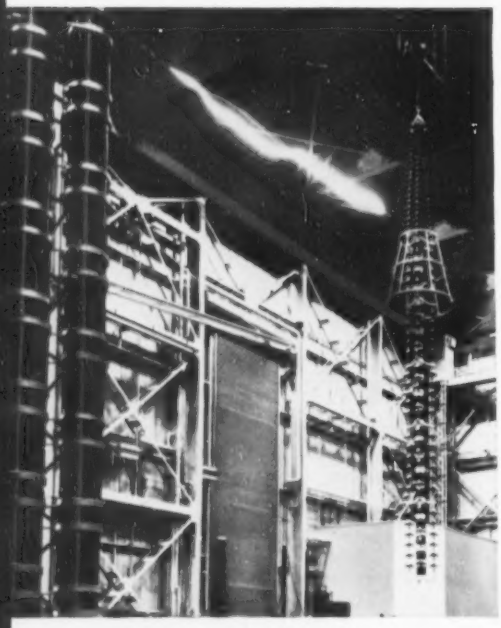
ANN ARBOR MICH

KEY ELEMENTS OF THE NEW ARRESTER, gap-unit and magnetic coil, are examined by H. M. Towne, Lightning Arrester Sales Manager at Pittsfield. Location of 4 multi-gap units and valve disks are shown in cutaway of basic 12-kv interchangeable unit (foreground) which has over 3 times discharge capacity and thermal endurance of other arresters. Greater margin of protection is given to system for surges up to 100,000 amperes.

ARE YOU OVER-INVESTING IN INSULATION?



TESTS PROVE PERFORMANCE of new Thyrite Magne-valve station arrester. Here a 330-kv arrester receives 7,500,000-volt lightning discharge during development at General Electric's High-voltage Laboratory in Pittsfield, Mass.

General Electric's new arrester extends scope of application for reduced-insulation in transformers

General Electric's recently announced Thyrite* Magne-Valve station arrester spotlights renewed attention on the potential cost savings inherent in reduced insulation levels on electric utility systems.

Many electric utilities already are taking advantage of the tremendous investment savings possible through reduced insulation levels. According to a recent industry study, all power transformers in the higher voltages of 230-kv and above were manufactured with reduced insulation. However, in the 138 and 161-kv ratings, reduced insulation was specified for only about 50% of the single-phase and 65% of the three-phase units.

General Electric's new arrester—with its outstanding protective efficiency for stroke currents even up to 100,000 amperes—has significantly lower sparkover and IR voltages than previous designs. Thus, this greater margin of protection provides assurance to all system operators, permitting wider usage of reduced insulation even on these 138 and 161-kv systems. Now a more positive approach to reduced insulation is offered to the industry with investment savings as high as 14% on power transformers alone.

More information about General Electric's revolutionary new station arrester and its application can be found in bulletin GEA-1304L. For your copy, contact your nearest Apparatus Sales office or write Section 301-257, General Electric Company, Schenectady 5, N. Y.

*Reg. Trade-mark of General Electric Company.

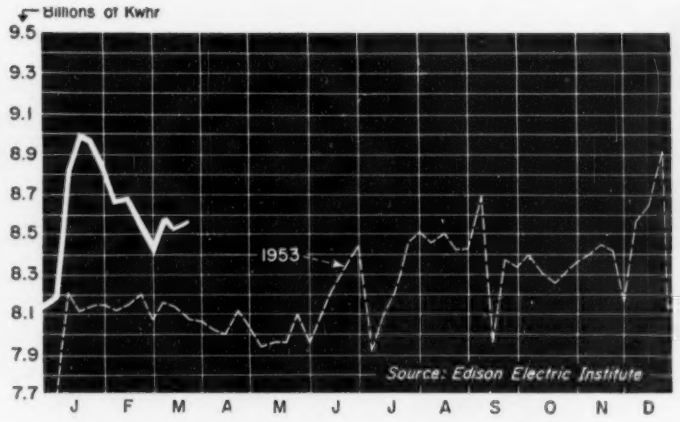
MORE POWER TO AMERICA

GENERAL ELECTRIC

VOLUME 141, NO. 13

March 29, 1954

Electrical World



Output Week Ended Mar. 20—8,572,000,000 Kwhr

Seasonally Adjusted Index†—162.2

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Mar. 20	+6.1	+2.0	+1.8	−1.3	+11.8	+22.1	+9.0	+3.3	+7.0	+0.1
Mar. 13	+4.7	−0.2	+0.2	−3.0	+9.5	+17.7	+8.1	+5.9	+8.1	+2.9
Mar. 6	+5.1	+0.9	+1.0	−3.4	+10.0	+20.6	+8.9	+4.9	+5.8	+0.9

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Dec.	81.2	78.1	75.5
Capacity (Million Kw)	Jan.	91.68	91.49	82.38
Production (Billion Kwhr)	Jan.	39.42	39.06	36.66
Hydro	Jan.	8.90	8.67	9.26
Fuel	Jan.	30.52	30.39	27.40
Fuel Consumption				
Coal (Million Tons)	Jan.	10.92	10.87	10.49
Oil (Million Barrels)	Jan.	8.29	7.62	7.70
Gas (Billion Cu Ft)	Jan.	67.41	70.78	60.06
Sales (Billion Kwhr)	Dec.	32.31	31.59	31.20
Residential	Dec.	9.77	9.02	8.91
Commercial	Dec.	5.60	5.50	5.21
Industrial	Dec.	14.83	14.95	15.11
Other	Dec.	2.12	2.12	1.98
Net Income Class A & B Companies ($ Million)	Nov.	84.26	76.19	80.63
Estimated Dec. '54 Peak (Million Kw)	Dec.	94.0	94.7	96.0
Kwhr per Residential Customer (12 Month Average)	Dec.	2,345	2,331	2,169
Revenue per Kwhr Residential Service (12 Month Average)	Dec.	2.74¢	2.75¢	2.77¢
Canadian Production (Billion Kwhr)	Dec.	5.72	5.45	5.54

Business Statistics

FRB Industrial Production Index†	Feb.	125*	124	136
Gross National Production Annual Rate ($ Billion)	4th Qtr	363.5	369.5	361.1
EW 4 Industry Production Index†	Feb.	114.6	117.3**	125.4
ENR Construction Cost Index††	Mar.	128.7	128.9	123.2
BLS Consumer's Price Index	Jan.	115.2	114.9	113.9
NEMA Insulation Materials Sales Index†	Jan.	124	133	174
NEMA Electric Appliance Sales Index†	Jan.	90	69	116
NEMA Household Refrig. Sales Index†	Jan.	95	53	93

*Preliminary **Revised †1947-49=100 ††1949=100

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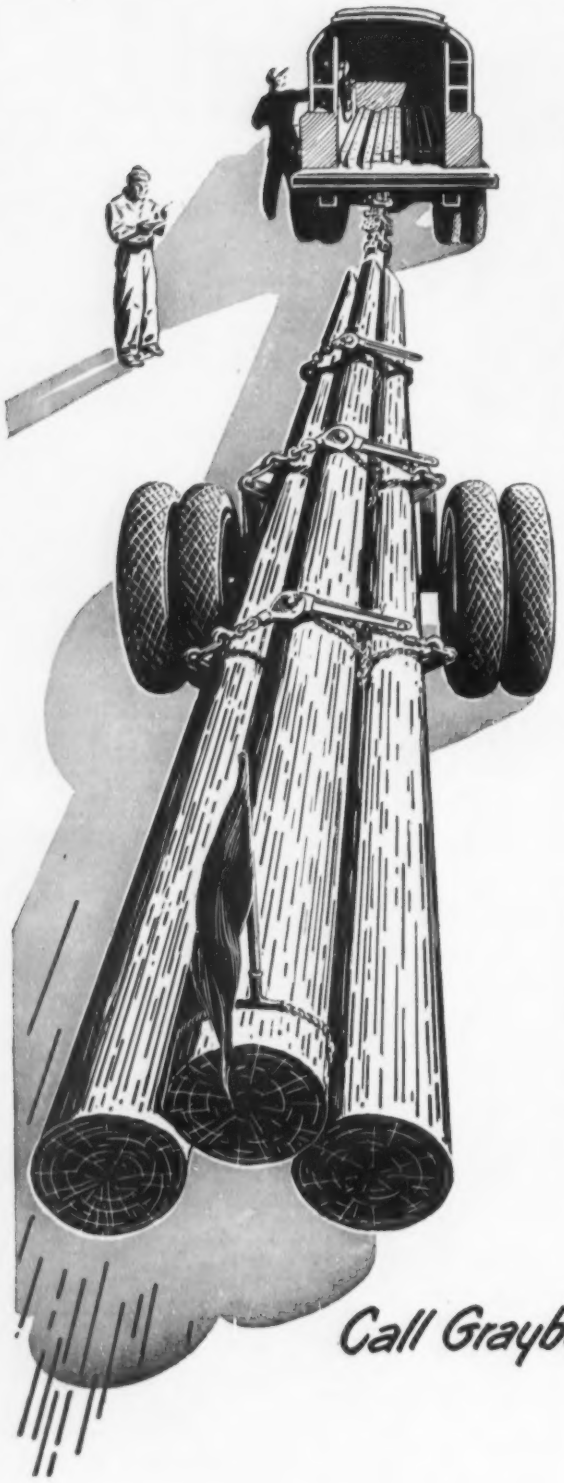
POLES and CROSSARMS

– via GraybaR



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THE ELECTRICAL WEEK

The Issue's News Highlights . . . Atomic Energy Commission officials disclose more than 200,000 Mw of nuclear power may be generated in U. S. by the year 2000 if the price is right.

AEC classifications officer says overclassification of atomic energy information is hindering scientific progress in this country.

C. A. Erdahl is dismissed as acting director of public utilities for Tacoma.

Margin of reserve capacity was the largest in the history of the electrical industry last year, Edison Electric Institute announced. Reserve (nameplate capacity) was about 13% above maximum demand at the December peak.

Southeastern Electric Exchange, meeting in Boca Raton, Fla., heard Walter Sammis, EEI's president, say the industry would welcome steps by the federal government to reduce the burden of overlapping regulation by simplifying its requirements and leaving more of the job of regulation exclusively with the state commissions. The supply of electric power, he said, is inherently a local business even though service areas may spread across state lines.

Westinghouse Pres Gwilym Price told the same meeting his company supports the five-company plan to redevelop the Niagara. "By some intellectual sleight-of-hand," he said, "even men of otherwise good judgment have fallen into the habit of advocating public ownership of power facilities at the same time they deplore other forms of statism."

The left-wing United Electrical Workers, independent, asked U. S. District Court to restrain General Electric Co from suspending workers who decline to testify before Congressional committees. Union declared GE's policy violated its work contract.

An explosion in a steam boiler at Greenidge Station of New York State Electric & Gas Corp in Dresden caused damage estimated at $200,000.

The Supreme Court's decision against the FPC upholding private rights of Niagara Mohawk Power Corp (EW, March 22, p 92) "strengthens the decision of the five New York companies in seeking federal approval for the redevelopment of the Niagara Falls by private enterprise," Earle J. Machold, president of the company, asserted.

Two granges in Oregon have adopted resolutions proposing formation of a PUD in Clackamas County and a portion of eastern Multnomah County. Area now is served by Portland General Electric and Pacific Power & Light. Other granges and organizations are being asked to join in creating the district.

Off the Washington Wire . . . AEC will announce within the next month or two the start of construction on a sound reactor designed to lead toward economical production of commercial power. This one is to be developed by North American Aviation and will be less than one-tenth the size of the 60,000-kw unit Westinghouse is now building. There are no plans for generating electricity from the North American unit.

FPC has approved for an interim period the rate provided in contracts negotiated last year between Bonneville Power Administration and five utility companies in the Pacific Northwest.

Its a good bet that FPC won't request a rehearing by Supreme Court on the Niagara Mohawk Power Corp case (EW March 22, p 92).

Report in Washington is that the air is clearing for negotiation of system-integration contracts between electric companies and generating and transmission co-ops in Missouri.

Reclamation Bureau power officials face more controversy over the marketing of energy from five government hydro projects in the Eastern Division of the Missouri River Basin. Conferences have been scheduled for early April with applicants for federal power in Montana, North and South Dakota, and portions of Minnesota, Iowa, and eastern Nebraska to give Reclamation officials some idea of how the available power should be allotted.

Recent Labor Settlements . . . Appalachian Electric Power and IBEW-AFL have agreed to a 3¢-an-hour increase with certain "inequity" adjustments in the higher classifications. Net average increase will be 5½¢ an hour. No fringe adjustments were involved . . . Virginia E&P and IBEW-AFL agreed to a two-year contract with no reopening clause. The contract calls for a 3¢-an-hour general wage hike along with certain "inequity" adjustments . . . Southwestern Public Service and IBEW-AFL have agreed to extension of their contract for 16 months effective March 1, with no increase in wage schedules but increased benefits in hospitalization insurance for pensioners and added vacation time. However, there is a wage reopening agreement if consumers price index goes over 117.9.

Winner of AIEE's Lamme Medal is Frank A. Cowan of American Telephone & Telegraph Co. Institute cited him for achievements in long-distance communication.

Executive Changes . . . Connecticut L&P appointed Gilbert J. Williams executive vice president and Alfred M. Wade vice president of sales to succeed the late Robert G. Ely. Robert H. Knowlton retired as chairman of the board.

AEC's Estimates on Nuclear Power Tell How Much, When

It's pretty well settled that commercially usable atomic power is on the way. Now, for the first time, Atomic Energy Commission officials are ready to face up to the questions of when and how much.

For the time being they are admittedly painting with a broad brush, basing their cost figures almost entirely on experimental reactors. They are counting on their five-year reactor development program (EW, March 15, p 7) to fill in a lot of the blanks. First of the five atomic power plants to be built under the program will be operated by Duquesne Light Co (EW, March 22, p 90) as the initial step toward developing commercially feasible power generation.

Competitive Factor . . . Table 1 shows the kind of competition that nuclear power is up against in the industrial electric power picture. To compete with even 10% of the modern steam generating units, production costs of nuclear power plants must be a little less than 8 mills per kwhr. That 8 mill figure is what AEC's Industrial Reactor Branch is shooting for by 1960.

By the year 2000, the AEC experts believe nuclear power production costs can be trimmed to around 6 mills and then will be able to compete with half the modern power generating units employing conventional fuels such as coal, oil, and gas. Big assumption in these figures is that production costs of conventional plants will stay about the same during the last 40 years of this century. AEC power experts believe that any gain in technical efficiency of the plants will be more than offset by rising costs of conventional fuels.

Increasing Share of Market . . . Tables 2 and 3 show what will happen if AEC and industrial reactor specialists can meet the production costs goals set. They indicate:

- The year 1960 will mark the entrance of nuclear power in the competitive industrial field.

- Nuclear power will, like hydroelectric power, be in tough competition with the more conventional fuels such as coal, oil, and gas. But between 1960 and 1970, nuclear plants will account for some 10-20% of all the new generation put in place.

- By gradually cutting production costs, nuclear plants stand to cop an increasing share of the power generation market. By the year 2000, approximately 22% of the total installed capacity will be nuclear fueled, and half of all the generating capacity put in place that year will use nuclear fuel.

Carrying these projections a step further, AEC's Industrial Reactor Branch estimates that during the years 1960-1985 the new atomic power plants will create a market for about $11 billion worth of equipment—eating into the normal growth of conventional equipment manufacturing. During the 15-year period, it figures some $3 billion worth of reactor components will be required, about the same amount of cooling system components, and about $5 billion worth of turbines and other more conventional equipment for converting nuclear energy into electric power.

1. Where can nuclear power compete?

If Nuclear power costs—mills per kwhr	then	It could compete with—% of the market*
9 mills		0%
7 mills		16%
5.9 mills		50%
4.9 mills		80%

*Based on power production costs for 6.5 million kw in 26 new plants in U. S. each larger than 100,000 kw.

2. How much nuclear power will be available? When?

Year	Total Capacity (Mw)	Nuclear Capacity (Mw)
1960	130,000	500
1970	200,000	11,500
1980	300,000	40,000
1990	450,000	95,000
2000	700,000	215,000

3. How big will annual nuclear additions be?

Year	Annual Increase in Capacity (total) (Mw)	Annual Increase in Nuclear Capacity (Mw)
1960	5,500	500
1970	8,000	1,750
1980	10,250	4,000
1990	10,900	7,900
2000	30,000	14,000

Source of information: AEC's Industrial Reactor Branch

More Declassification Urged

Excessive fears in U.S. have brought about 'ostrich-like' posture on nuclear matters, hindered scientific progress, head of AEC's Classification Office tells Atomic Industrial Forum

The Russians achieved their present state of atomic development through the efforts of Soviet scientists and engineers, not through the passing on of atomic secrets by spies, the director of Atomic Energy Commission's Classifications Office recently told businessmen interested in nuclear development.

The director, James G. Beckerley, spoke at a forum on "Business Opportunities in Atomic Energy" staged in New York by Atomic Industrial Forum, Inc.

The kind of thinking that has led to the belief that the USSR got most of its atomic information from spies has been responsible for overclassification of non-weapons data, Beckerley believes. And this in turn, he says, has kept American scientists from competing as effectively as they could in development of atomic processes for peacetime use.

Business Involved . . . This is where the atomic businessman comes in: He can't hope to compete with Soviet developments unless a more sensible declassification procedure is set up, Beckerley feels.

"We should cease overestimating the value of our non-weapons data to the Soviet project," the classification director said. "An ostrich-like posture in this business could become a national disaster, by retarding scientific progress in the United States. We are in a competitive situation, and you can't be an ostrich in that situation."

Espionage assisted the Soviet project, he said, but only in a secondary way.

"Why did the USSR become armed with atomic weapons so soon?" he said. "Personally, I believe it was primarily through the efforts of Soviet scientists and engineers backed up by a ruthless totalitarian resolve to dominate the world. It would be dangerous to assume otherwise."

AIF to Have Atomic Library . . . AEC is doing what it can to disseminate declassified information on nuclear processes to industry, Alberto F. Thompson, chief of the agency's Technical Information Services, pointed out. He announced arrangements had been made to establish the first special depository of atomic information for industry at AIF headquarters, 260 Madison Ave, New York 10, N. Y.

"This service," he said, "will supplement the 40 or more AEC depository libraries primarily serving scientific and academic audiences and be aimed at meeting the growing need for atomic energy technology of particular interest to industry."

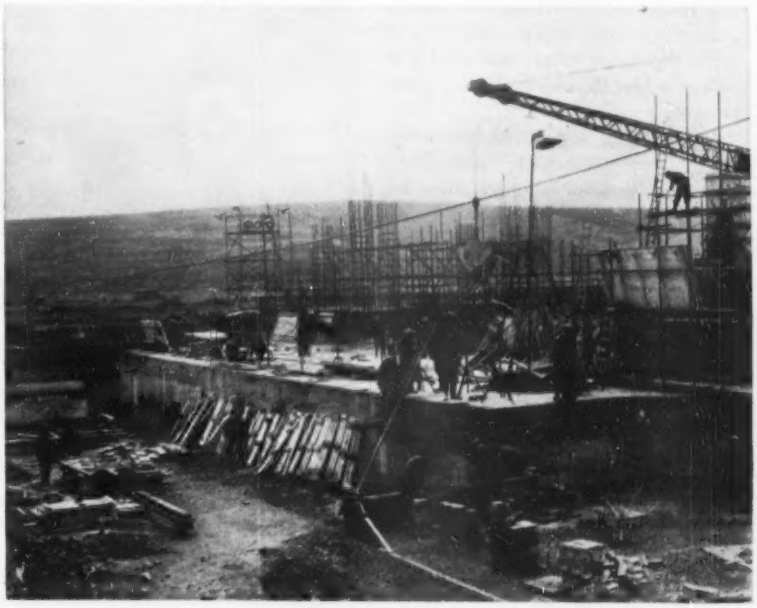
Unclassified engineering drawings of specific pieces of equipment developed within the program will be offered for the first time through this medium. AEC, Thompson said, has already taken steps to set up the same sort of service in three other sections of the country.

New England Committee on Atomic Energy Named

Connecticut's Gov John Lodge has appointed ten men to a New England Atomic Energy Committee. The new group will survey future peace-time use of atomic energy in the six-state area. Committee will hold an organizational meeting shortly.

Members of the new committee are: Lt Gen Leslie Groves, vice president of Remington Rand Inc, former head of Manhattan Project, which developed the first atomic bomb; Sumner Pike, former chairman of Atomic Energy Commission; William Webster, vice president of New England Electric System; Dr Shields Warren, New England Deaconess Hospital.

Ralph Booth, Boston engineer; Dr Karl T. Compton, chairman of the corporation at Massachusetts Institute of Technology; Wallace Fay, vice president of Protor Marble Co; Maj Gen Frank D. Merrill, New Hampshire Highway Commissioner; Dr Arthur Quirk, physics professor at University of Rhode Island; and Hartley Rowe, vice president of United Fruit Co.



Work Advances on Britain's A-Station

A natural uranium reactor, one of two, is taking shape at Calder Hall, Cumberland, England, as the British Ministry of Works for the Department of Atomic Energy makes progress in an experimental atomic power station. Calder Hall, which will house both reactors, is the first atomic power station to be built in Britain. Work on it began in May, 1953.

House Votes Funds for Corps

New money okayed for Army Engineers' hydro projects totals $192.6 million, a cut of $14 million from Ike's request

The House has voted $192.6 million of new money for 16 hydroelectric projects now under construction by the Army Corps of Engineers.

The bill now goes to the Senate, which can usually be counted on to raise the House figures.

House-approved funds for corps power projects during the next fiscal year is just $14 million under the amount requested by President Eisenhower for this purpose. A cut of $3.5 million was made in the Presidential budget for the Garrison reservoir in North Dakota. This will prevent the corps from acquiring additional land in the Williston, N. D. area, and thus limit the height of the Garrison dam.

Cut for Dalles Project . . . Only other sizable cut in the Presidential requests was for The Dalles lock and dam in Oregon for which the House allowed only $29 million of the $34.1 million requested. Main reason for this reduction, the House Appropriations Committee report said, was to bring the funds within the limit previously authorized for Columbia Basin project.

In a separate action, the House Appropriations Committee released a $2.3 million prior appropriation for the 200,000 kw Table Rock hydroelectric project in southwestern Missouri. This has been held up for the past year pending further study by the corps.

Following are the sixteen multiple-purpose corps projects and the funds voted by the House for use in the fiscal year beginning July 1:

Blakely Mountain Reservoir (Ark.)	$1,600,000
Folsom Reservoir (Calif.)	14,000,000
Jim Woodruff Lock and Dam (Fla.)	5,000,000
Buford Dam (Ga.)	5,800,000
Clark Hill Reservoir (Ga.)	2,170,000
Albeni Falls Reservoir (Idaho)	4,000,000
Gavins Point Reservoir (Neb.)	11,000,000
Garrison Reservoir (N. D.)	24,000,000
McNary Lock and Dam (Ore.)	24,000,000
Lookout Point Reservoir (Ore.)	3,000,000
The Dalles Lock and Dam (Ore.)	29,000,000
Fort Randall Reservoir (S. D.)	17,000,000
Oahe Reservoir (S. D.)	9,000,000
Cheatham Lock and Dam (Tenn.)	4,000,000
Old Hickory Lock and Dam (Tenn.)	12,000,000
Chief Joseph Dam (Wash.)	27,000,000
	$192,570,000

Construction Delay Seen . . . Cutback in funds for The Dalles Dam will mean a one-year delay in schedules, Corps of Engineers spokesmen asserted. The statement was made after the House Appropriations Committee had trimmed funds for the project. The House then went along with the committee by approving the cut.

Earlier a one-year delay in construction of Chief Joseph Dam had been predicted when the Budget Bureau cut funds for the project from $27 million to $30 million. The Budget Bureau figure for Chief Joseph was not cut further by the House.

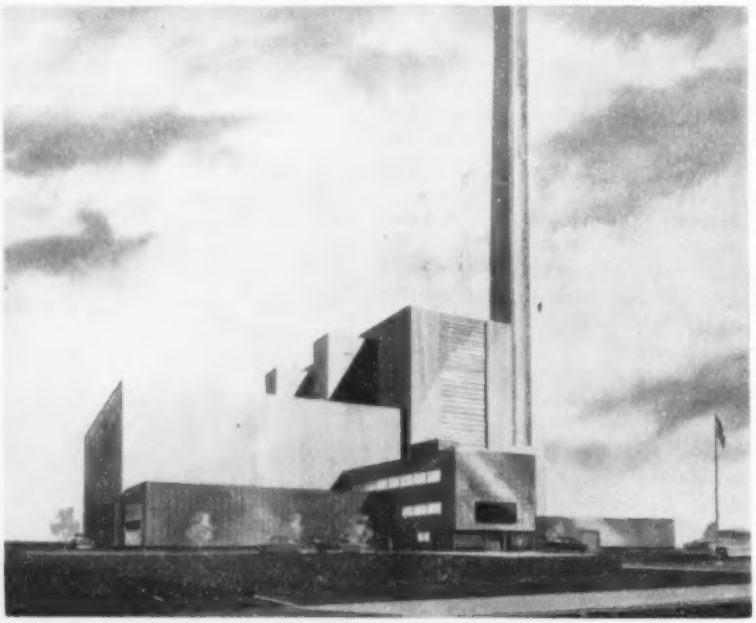
Pelton, Cowlitz Licenses Are Snarled in Courts

Federal Power Commission has petitioned Ninth Circuit Court of Appeals for a rehearing on its decision invalidating the license granted Portland General Electric Co for its proposed Pelton Project on the Deschutes River.

The project was opposed by the State of Oregon and the Oregon Fish and Game Commission.

Petition for the rehearing was interpreted as a necessary preliminary to an appeal by FPC to the Supreme Court.

On a second case, the Supreme Court may act within the next week or two on a petition by several Washington state agencies appealing a lower court decision upholding a license granted Tacoma for the Cowlitz project.



Aluminum Exterior for Morro Bay Plant

Pacific Gas & Electric Co's 300,000-kw Morro Bay steam plant (pictured above) will feature fluted aluminum and porcelain enamel exteriors fashioned in broad panels when the $44-million project on the San Luis Obispo County coast is completed. First unit is scheduled to be in operation next year with the second unit slated to go on the line in 1956.

Located on a 136-acre site, the flat-roofed building group will have a single stack, 450 ft high and made of reinforced concrete, that will stand on bay side of plant. Boiler building will be about 145 ft from ground to roof. Turbine room and control bay will extend easterly from boiler building and transformers will stand at easterly side of turbine room. Facades of machine shop, office building, and warehouse, done in three blending tones of ferro-porcelain enamel, will join main building on its northerly side.

Erdahl Dismissed . . .

. . . as Tacoma's acting director of public utilities. Dean Barline is named to fill post

Tacoma, Wash., Public Utilities Board has dismissed C. A. Erdahl as acting director of public utilities and appointed Dean Barline, assistant city attorney, to fill the post until a permanent successor can be named.

Barline shortly thereafter named Henry Cole, chief project engineer for Tacoma City Light, as superintendent of the Light Division to succeed J. Frank Ward, who became managing director of the Washington State Power Commission earlier this year. The Cole appointment had the board's approval, Barline said.

Long Service . . . Erdahl had served as head of the city's utilities nearly 11 years, ten of them by election as commissioner of public utilities, a post abolished in charter changes last year. He had been serving as acting director and had been regarded as a leading contender for a permanent appointment to the position until the board, several days before dismissing him, declared him out of the running. The board asked Erdahl to resign but, failing to receive his resignation in 24 hours, announced his dismissal.

The board declared that Erdahl's engineering background and, "in some ways," his administrative background, did not meet qualifications for the position. Board member Alfred Johnson declared that the net income of the Light Department was going down at an "alarming" rate even though gross revenues were going up. The board revealed it had narrowed the field of 78 applicants for the post to four, all from outside the state.

Dismissal Protested . . . Walter S. Gordon, Tacoma consulting engineer and chairman of the State Power Commission, speaking as a taxpayer, charged the other four members of the board had been influenced by Chairman Gerrit Vanderende, who Gordon declared long had been bent on "sacking" Erdahl. Gordon also charged that the action was part of a move to put Tacoma utilities under the city manager, rather than be independent under a utilities director. None of the other applicants for the job measure up to Erdahl, he said.

Making Plans for St. Lawrence Project

Robert H. Saunders (left), Ontario Hydroelectric Commission chairman, discusses plans for the St. Lawrence River power project with Robert Moses. Moses is the newly appointed chairman of New York State Power Authority, designated as the U. S. agency to proceed with Canada in construction of the joint project.

Meanwhile, the House voted last week to require New York State to pay $245,000 for services to be performed by the U. S. section of a Joint Engineering Board in connection with the construction of the power project.

In voting funds for the board, the House said that no part of the funds would be available until an agreement had been reached with the New York Power Authority for full reimbursement of these funds.

Unless the Senate rewrites the funds bill, this would mean New York Authority would have to agree to contribute this money before work can start.

Ike's OK of Echo Project Tied to New Finance Plan

President Eisenhower's strong endorsement has stepped up the chances for authorization of the billion dollar Colorado River storage project and its two big power dams at this session of Congress. The President specifically endorsed the Interior Department's proposed storage and power projects —Glen Canyon (800,000 kw) and Echo Park (200,000 kw).

Eisenhower justified the upper basin plan as an example of federal-state cooperation that carries out the Administration's approach to water resource development. His approval was tied to a Budget Bureau proposal for "sound financing" that would set up a fund for the entire project.

The Budget Bureau is now drafting legislation, in cooperation with the Interior Department, that would set up this financing method. It does not differ too much from the basin account procedure proposed in bills now before Congress. Both methods have the purpose of using power revenues to help pay the cost of participating irrigation projects in the upper basin.

Main point of difference is that the Budget Bureau proposal would raise the basin account above the status of a mere bookkeeping arrangement and make it a systematic revolving fund procedure for handling all project financing, with the Interior Secretary responsible for all receipts and disbursements.

The House Interior subcommittee postponed final action on its Upper Colorado bill when the Administration announced the new proposals.

IN THE INDUSTRY

It is not surprising when citizens in an area that has long been under federal domination should cry for early action when a plan is proposed to restore their independence. The area is the Pacific Northwest, which has looked to Washington for the bulk of its electric power requirements since the beginning of the string of federal dams on the Columbia River. The plan is the "partnership concept" of the Republican Administration, whereby federal and local agencies could jointly build multipurpose projects that contain electric power features.

Need for action in Pacific NW now essential

The appeal for this action comes from the Inland Empire Waterways Association, Walla Walla, Wash., a nonpartisan group whose membership is widespread and representative of major interests in the Pacific Northwest territory.

No Details on Power Program . . . In an analysis of the Administration's electric power partnership program—the association states—that neither the Interior Department nor anyone else in the Administration has spelled out any details of how the program should work.

Concluding the analysis is the statement by the association that "the people of the Pacific Northwest want a working partnership on a region-wide basis that will insure maximum development of water resources. They expect the federal government to measure up to its responsibilities and to offer a concrete program embracing all levels of government participation and private enterprise cooperation."

In the face of this request for information it is necessary for all groups, both public and private alike, that would be a party to joint ventures to let the public know that something is being done. To date this action has been taken by the Congress (EW, Feb. 22, p 90). It happened in the House committee hearings on a measure that would permit the Interior Department to cooperate with nonfederal agencies in the development of multipurpose projects.

Three Bills Introduced . . . Three bills have been introduced covering partnership action on specific projects with power features. These are:

- A joint venture between the Army Corps of Engineers and the City of Eugene, Ore., to build the $34 million Cougar Dam on the south fork of the McKenzie River in Oregon.
- A joint venture between state agencies in the state of Washington and the federal government in developing the Priest Rapids Dam on the Columbia River.
- A bill authorizing and directing the Secretary of the Interior to participate with any local public body in the construction of single or multipurpose projects.

The Administration has requested that $10 million be appropriated to federal construction agencies for use in planning or building waterway projects.

Appreciating how slow the Congress does move, this can be considered a good start. Further action by an economy-minded government can be speeded by an eagerness on the part of the Pacific Northwest utilities to underwrite the power features of other projects that have been proposed or authorized.

The cry for action has been made. But it is up to the electric industry in the Pacific Northwest to answer the call.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Switching on the last section progressively of a multiple bank of capacitors can result in inrush currents having a rate of rise in excess of 1,000 amp. per microsec. The previously charged sections add to the inrush.

Gas pressure increase improves the ability of the gas to absorb heat from generator coils but effects no major change in the temperature rise of the conventional winding because the thermal drop through insulation and steel remain sensibly unchanged.

Zirconium has a high melting point, but it does not appear to have attractive high temperature properties because it loses its strength rapidly above 900 F.

Carrier telephone frequency equipments have sensitivity and selectivity adequate to permit 10 kc spacing throughout the carrier band, but interfering signals must be low to avoid difficulty.

Advance provision for boiler television may avert large structural outlays to provide through-the-floor paths for the image of gauge-glass or flames.

Sulfur hexafluoride is highly unreactive even with copper and silver at red heat. It is also insoluble in water or aqueous alkali solutions.

Checking with synchroscope before closing generator breaker pays off, even when generator is "known" to be tied to system by parallel path.

Zirconium is eleventh in prevalence in the earth's crust, exceeding copper, lead, iron, and zinc in total reserves available.

A 500-Mw turbine using steam at 3,200 psi, 1,150/1,100/1,100 F reheats should be able to give 8% better thermal performance than a 250-Mw machine using steam at 2,000 psi, 1,050/1,000 F reheat.

Aluminum melting point is much lower than that of copper. Aluminum conductors will therefore burn off at correspondingly lower temperatures when short circuits occur.

Diesels were not successful in the 20 years engineers tried to make them like steam engines nor in the next 20 when they tried to make them like gasoline engines. When they made them like diesels they were a success. (C. F. Kettering)

Resuscitation from electric shocks of 5 to 40 kv has been found 70 to 100% more successful than from shocks up to 750 v.

BOKARO STEAM PLANT
Damodar Valley Corporation, India

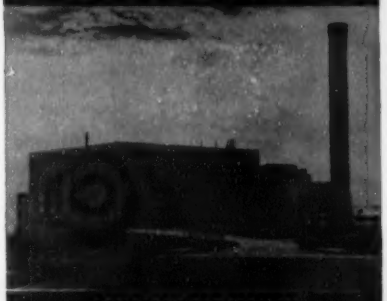
LA CENTRALE DE DECHY
Houilleres Du Bassin Du Nord et
Du Pas-de-Calais, France

ROCKWELL STATION
Manila Electric Company, Philippines

READING POWER STATION
Palestine Electric Power Corporation, Ltd., Israel

AMER POWER STATION
N.V. Provinciale Noordbrabantsche
Electriciteits-Mij., Holland

TAVAZZANO STATION
Societa Terma Electtrica Italiana, Italy



SAN FRANCISCO STATION
Cia. Panamena de Fuerza y Luz, Panama

SAN JUAN STEAM ELECTRIC STATION
Puerto Rico Water Resources Authority,
Puerto Rico

Outside the U.S.A., *too...*

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Since 1950 alone, for example, nearly 2,000,000 kilowatts of C-E powered capacity has been placed in service in eighteen nations overseas. Shown here are a few of the postwar foreign power plants served by C-E Boilers. Substantial additional capacity is now in various stages of completion.

These foreign installations are transporting modern American power practice to literally all corners of the world. A recent example is a contract for three C-E Reheat Boilers for two Japanese utility stations. Each of these boilers will serve a 75,000-kw turbine-generator and is designed to produce steam at 1465 psi with a primary temperature of 1005 F, reheated to 1005 F.

Thus, throughout the free world – from Australia to Venezuela ... Iceland to Israel ... in fact, in two of every three member nations of the U.N., as well as several important nonmembers – C-E Boilers are helping to provide low-cost electricity – the first requirement for better living and economic progress.

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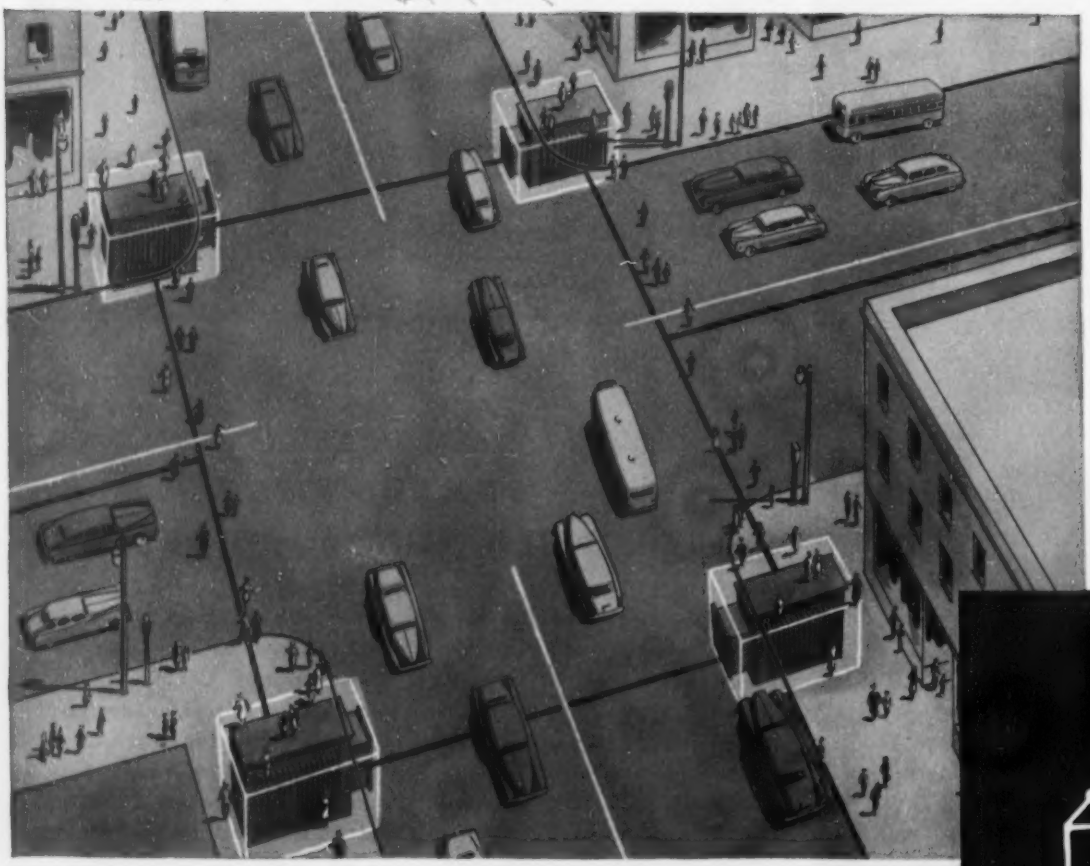

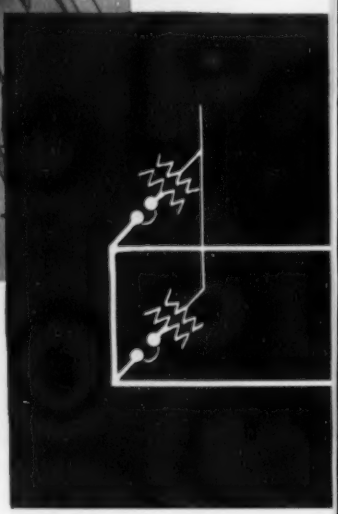

Moloney Network Transformers are available in all E.E.I.-NEMA standard Kva and voltage ratings with standard and optional mechanical features.

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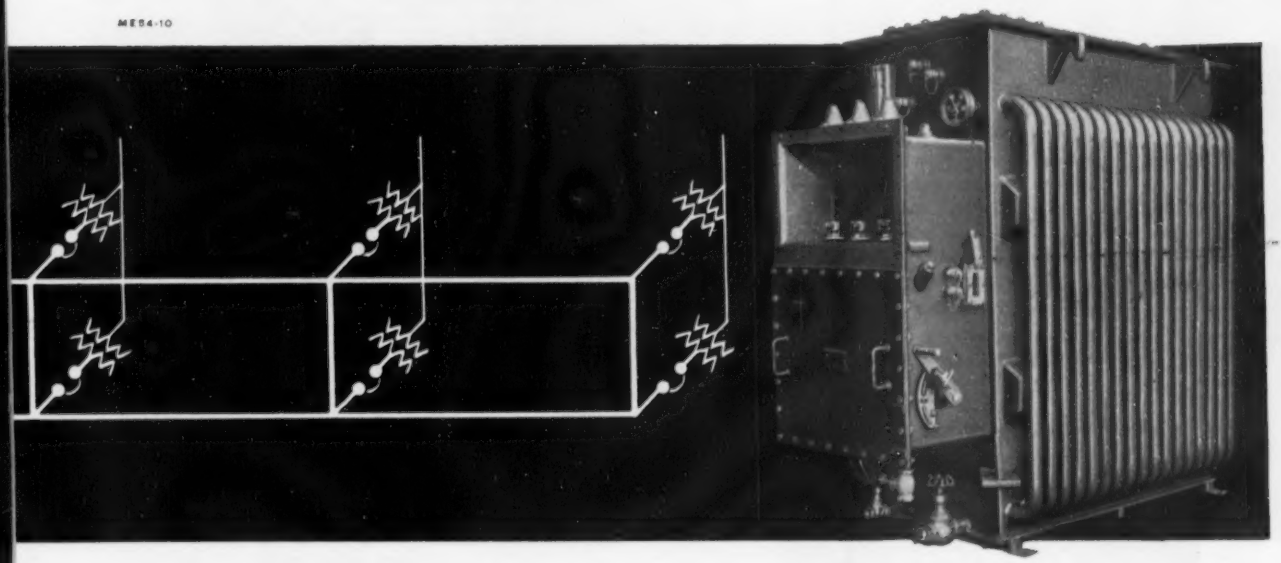
JAMS UNDER THE STREET

Your network system resembles, to an astonishing degree, the very streets under which it lies, and your network transformers have much the same job as the traffic cop in keeping the kilowatts constantly moving along your lines to the customers. But these transformer "traffic cops" work all around the clock without relief. They must safely handle the fluctuations in daily load . . and must be ready to meet and handle the ever increasing demands of your customers.

For, if a network transformer falls down on the job, if the traffic is more than it can handle, the resulting failure throws added burden on the rest of the network . . . may cause a serious traffic jam of kilowatts that cuts service to customers, costs considerably to repair.

That is why you specify equipment upon which you can rely. Moloney Network Transformers enjoy the same high reputation of all Moloney equipment . . . they combine all the engineering, design, and fabricating experience which is the mark of Moloney, a firm which has specialized in the manufacture of better transformers to meet utilities problems for 58 years.

ME54-10



ELECTRIC COMPANY

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DEAD-ENDING ALUMINUM is an old story with us . . .

With the advent of the aluminum conductor and its growing acceptance and use during the past few years, we here at Pinco have kept abreast of this gradual change from copper to aluminum conductors by designing our products to meet both present and future industry requirements. Typical of these, are the three new Pinco Strain Clamps shown here which are designed to accommodate either ACSR or All Aluminum in distribution construction.

Yes, we are experienced hands when it comes to clamping aluminum and out of experience such as this, have come the many Pinco products which have been serving the electrical industry faithfully for *thirty-three years*. So if you have a problem, related to clamping aluminum conductor on your distribution and transmission lines, we invite you to PUT IT UP TO PINCO.

FEATURES

- Easy to blanket when working lines "hot"
- Excellent snubbing action, making them "easy" on the conductor.
- "Come-along" eye provided in all three clamps for easy installation of conductor.
- Quadrant type design allows continuous "running" of conductor—eliminates necessity of cutting the conductor at strain points to make "jumper" loops.
- Constructed of highest grade malleable iron, properly annealed and normalized, then hot-dip galvanized.
- Steel U-Bolts and Cotter Bolts, hot-dip galvanized. Spring Brass Cotter Keys.

PINCO 4550
Will accommodate All Aluminum conductors and ACSR from .2 to .55, including No. 4 through No. 1/0 ASCR or All Aluminum.

PINCO 4468
Designed for use with 2/0 through 4/0 ACSR or All Aluminum conductors ranging from .2 to .68.

PINCO 4485
Recommended for use on 226,800 C.M., 300,000 C.M. and 336,400 C.M. ACSR or All Aluminum.

All three clamps can be used for smaller conductors where a wide range is desired. Liners furnished if required.

PINCO INSULATORS
BRIGHT ON THE JOB

The Porcelain Insulator Corporation
LIMA, NEW YORK

Sample Strain Clamps Gladly Furnished on Request

Power Hearings . . .

. . . before Hoover Commission task force will be held in May and June at four cities

Electric utilities may either submit briefs or appear in person before the Hoover Commission task force on water resources and power.

This task force is a working group of the new Hoover Commission which is studying means of promoting economy, efficiency, and improved service in the executive departments of the federal government. The task group is assigned to the power and water resource development activities.

Utility officials who have suggestions along these lines will be heard during public sessions of the task force at the following times and places:

San Francisco, Calif., May 3
Denver, Colo., May 17
Chattanooga, Tenn., June 1
New York City, June 14.

The hearings will be conducted along the same lines as Congressional hearings. A person or an organization spokesman may not appear more than once during the sessions. Oral presentations must be brief. Witnesses are asked to submit 45 copies of their proposed statements at least two weeks in advance of the public hearings.

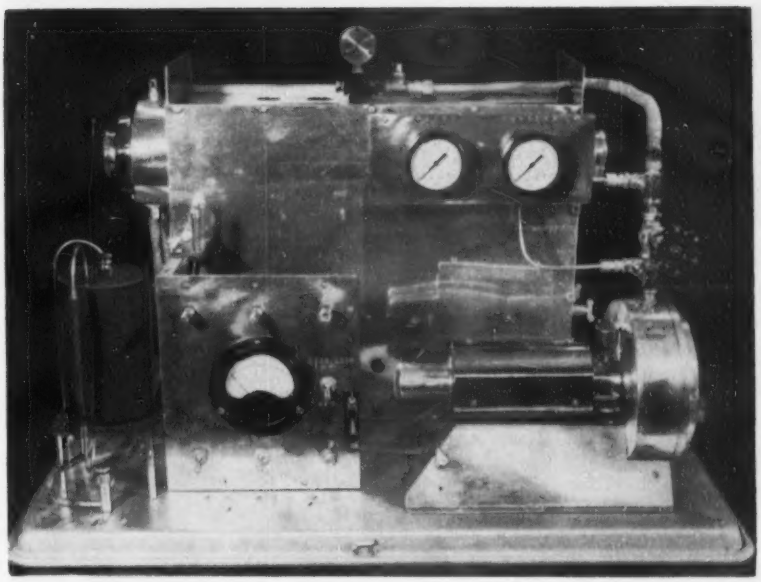
Interested parties may also submit briefs or statements to the task force without appearing at a public hearing. All such briefs should be put before the task force not later than June 1 if maximum use is to be made of them.

Those submitting briefs are also asked to send in 45 copies so that they may be made available to the entire commission and its staff.

Further inquiries should be addressed to Charles D. Curran, Task Force Administrator, at General Accounting Office Building, Washington, 25, D. C.

Subterranean Energy

Republic of El Salvador plans to harness its volcanoes' subterranean energy as a result of a study made by two Italian scientists of the country's volcanic energy potentials. Cost of installation of equipment and a trial generator is estimated at $3 million. Unit is expected to produce 12,000 kw.



Model Steam Plant Shows . . .

. . . 6th Graders How Power Is Made

Model steam generating plant (shown at top) was demonstrated to sixth grade science class at Kenwood School, Cedar Rapids, by William DuVall (bottom picture) for Iowa Electric Light & Power Co. Demonstration is one of many put on in utility's area by its public relations department in school classes from 5th grade through high school.

Produced by Utility Service Co, Cedar Rapids, model actually generates power. It has a transformer to step-up generator voltage to 110 v and alcohol-fired boiler that operates at 15 psi with turbine running at 1,800 rpm. Two-pole generator produces current at 5 v, 60 cycles.

Peep holes of transparent material in the ends of the boiler drum permit pupils to see the swirling steam. The turbine consists of a small disc with small buckets on it. It will continue operation while a peep hole in the case is opened, thus permitting students to see how it operates. A pilot light is connected to the 115-v side of the step-up transformer. The alternating current characteristic is demonstrated by slowing down the generator to produce a flicker.

On Taiwan

The Chinese Nationalists are developing power to meet the daily needs of the people

THE AUTHOR T. C. Tsao, who now works in New York for Consolidated Edison, was in charge of rehabilitating Shanghai's power system immediately after the Japanese surrender there. He later guided redevelopment of the power system on Taiwan (Formosa), which he describes in this article. Tsao, fluent in Chinese and English, translated the headline above into Chinese characters at right.

台灣

自由中國之基地開

發電力以裕民用

T. C. TSAO, formerly Commissioner of Public Utilities for Greater Shanghai, Republic of China

At the height of World War II, Japan had diverted 38% of Taiwan's total power capacity to production of aluminum. With other industries taking a large chunk, this left little for the people to consume. When the Chinese National Government took over in 1945, power plans were reoriented to meet daily needs of the island's inhabitants.

The stride of power development in Taiwan since then follows the firm governmental policy to develop the people's daily necessities such as fertilizers, textiles, fuel oil, mechanical equipment and chemical industries. Take the case of chemical industries. Their total consumption of power in 1943 was only 41,182,000 kwhr, while in 1950 it was 146,043,000 kwhr, and in 1951, 287,887,000 kwhr. Industrial production in 1952 was considerably larger than 1951, and this increase continued through 1953.

Taiwan, known to the West as Formosa, with an area of 14,000 sq mi and a population of 7,869,000, is served electrically by Taiwan Power Co. The company was organized by the Chinese National Government at the end of World War II by taking over all the power facilities on the Island of Formosa and on the nearby Penghu Islands. The Japanese-built electric plants, badly damaged by American bombers during the war, could supply a peak load of only 38,000 kw when the Chinese took control in 1945.

Without foreign financial aid for the first year and three quarters, the Chinese restored Formosa's industrial plants, including electric power equipment. They received aid from American consulting engineers who had been invited as industrial advisers to the National Government.

The Power System

The island is bisected from north to south by a high central mountain range. The eastern part of the system operates in a relatively small mountainous area covering about 3,200 sq mi. Taiwan's major power facilities are on the western coastal plain (see map). There are at present 32 generating stations in operation, 24 hydro and eight steam-electric. They have an aggregate installed capacity of 362,-145 kw, with hydro and steam in the ratio of 5 to 1. All stations, except a few small ones, are connected to form an integrated system. Most of hydro stations are operated at medium. Highest head is 1,320 ft. All existing hydros, with the exception of the two largest Sun-Moon Lake stations, are run-of-river plants. The largest existing thermal plant is at Peipu, in the north, with a capacity of 38,000 kw.

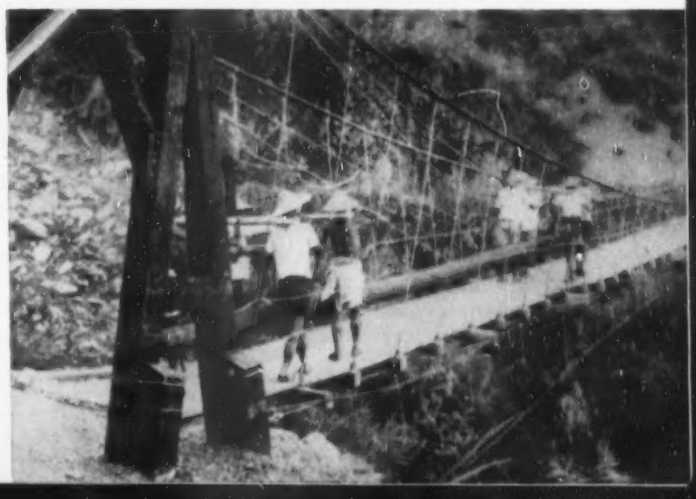
The 140-kv transmission lines as shown on the map comprise the backbone of the integrated system. They consist of four steel tower circuits, originating from Sun-Moon Lake No. 1 and No. 2 Stations. Two of the circuits extend northward to Patu substation and the other two extend southward to Kaohsiung substation, each pair being about 100 miles long. The two north-bound circuits terminating at Patu are connected to Peipu steam plant 10 miles northeast of Patu by a 66-kv tie. Kaohsiung, the southern terminus of the 140 kv tie, is the center of the island's heavy industry. The frequency of the system is 60 cycles. Power is distributed mainly by 33-kv lines. The voltage used for lighting and for small motors are 100v and 200v 3-phase, respectively. The distribution lines total 6,400 miles, reaching practically every corner of the island.

(*Continued on page* 19)

SUN MOON LAKE: Taiwan's chief hydro source is also the chief vacation resort of the Nationalists' fortress island

WOODEN POLES as well as steel towers were used for cross-island tie, integrating eastern and western grids

HUMAN LABOR replaces mechanized transport in setting of poles in rough mountain country at island's center



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A wire or phone call to the nearest of these centers will bring help in a hurry . . . often in a matter of hours. And the service you get is expert. Honeywell men are trained, by factory schooling and field experience, in the most modern methods of keeping good instruments in peak condition.

Frequent check-ups *prevent* emergencies . . . protect your instrument investment. The economical way to do this is a Periodic Service Contract, which brings a Honeywell man to your plant at regular intervals to inspect, clean and adjust your instruments and controls. Your local Honeywell office will be glad to give you full details, and to arrange a custom-fitted contract for your requirements.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

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BROWN INSTRUMENTS

First in Controls

Sun-Moon Lake No. 1 (known as Ta-Kuan) and No. 2 (known as Chu-kung) have installed capacities of 100,000 kw and 43,500 kw, respectively. They are operated hydraulically in cascade and derive their source of energy from the Sun-Moon Lake amidst scenic mountains near the center of the island. A dam 160 ft high diverts Chu-sui River, the largest stream in Taiwan, through a 8.5 mile tunnel to the lake. From thence a pressure tunnel two miles long leads to No. 1 station with a drop of 1,005 ft. A 2.7 mile gravity tunnel leads the discharged water to No. 2 station with a further drop of 408 ft. Power generated at 11 kv is stepped up to 140 kv and tied to the trunk transmission line.

Problem of Expansion . . . The great demand of power due to the rapid growth of industries required Taiwan Power to launch a rehabilitation and expansion program which contemplates addition of 14 generating plants with an aggregate capacity of 300,750 kw. This addition will nearly double the generating capacity of the island. Following is a brief description of some major projects, mostly sponsored by the U. S. Foreign Operations Administration:

Project	Type	Units	Size	Completion Date
Wulai Extension	Hydro	1	11,250 kw	May 1954
East West Tie	Transmission	2	20,000 kw	Sept. 1953
Li-wu Extension	Hydro	2	15,000 kw	Feb. 1954
Tien-leng	Hydro	2	26,500 kw	April 1953
Wu-sheh	Hydro	2	10,000 kw	1956
Tung Men	Hydro	3	7,000 kw	Mar. 1955
Peipu Extension	Steam	2	20,000 kw	Mar. 1955
Nanpu	Steam	1	40,000 kw	May 1955
Chukeng	Hydro		100,000 kw	1957
Nanshih	Hydro	2	10,000 kw	1957

Wulai Hydro Extension 1 . . . The Wulai hydro project in the North, near Taipei, was left unfinished because of World War II. As the need for additional generating capacity was very acute in 1949, the engineers of Taiwan Power undertook to complete the station. The first unit of 11,250 kw was put on the line in December, 1950, and installation of the second is now in progress. The completion of this project by Chinese engineers gave impetus for the start of FOA (then Mutual Security Administration) fund for subsequent projects.

East-West Tie Line . . . To bring over surplus power from the east side, a first cross-island 66-kv tie line was constructed and completed in December, 1951. The line is 28 miles long, but passes over extremely rugged terrain, from sea level on the east coast to an altitude of 9,240 ft in the central mountain range. For expediency, a wooden pole line was built first. All materials were transported by human labor along narrow and sharp winding trails. Construction of a parallel steel tower line was completed last summer, with materials purchased with FOA funds. Each circuit has a capacity of 20,000 kw.

Tienleng Hydro Station . . . The Tienleng hydro station is situated on Ta-Chia-Chi, a river in Central Taiwan. Construction work on this station was interrupted at the end of the Second World War. Full scale civil engineering work was resumed by Taiwan Power in 1950. A long tunnel section that had troubled the Japanese engineers was completed within scheduled time. The first unit of 26,500 kw was put into service in August 1952 and the second in April, 1953.

Tungmen Hydro Project . . . The Tungmen hydro plant, located on the east coast, was built and placed in service during the war. After a year and half of operation, an unprecedented flood in September, 1944, destroyed the power house and severely damaged the intake and diversion dam. Succeeding storms completely buried the power house in the river bed. Reconstruction of the diversion and intake structures are now underway. Three 7,000-kw units have been ordered. The station will be built underground in order to be safe from further silting of the river bed and from landslides, and is expected to be completed within a period of two years.

Peipu Extension . . . The Peipu steam-electric station with existing capacity of 38,000 kw is situated on the north coast near Keelung. Present plan calls for installation of two 20,000 kw units of 850 psi and 900 deg F. The project is completely financed by Chinese National Government with FOA guarantee. The machines have been ordered from manufacturers in the United States.

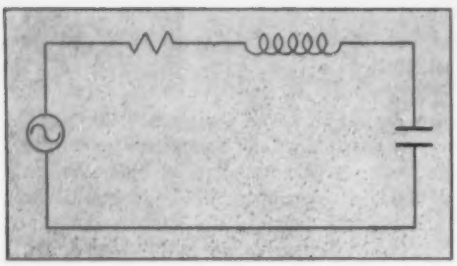
Nanpu Project . . . The Nanpu steam-electric project is located near the south tip of the island. It is a totally new thermal station with the object of firming the hydro capacity and it will be also used for peaking purposes. The largest concentration of industrial loads is in the south, where very little hydro power is available. The complete scheme for Nanpu is for a 200,000-kw steam plant with two units of 40,000 kw and two of 60,000 kw.

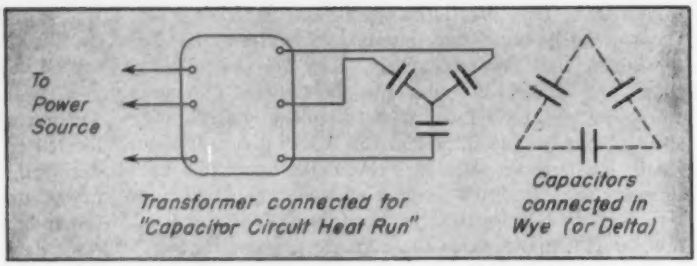
Wusheh Hydro Project . . . The Wusheh hydro project of storage type is situated in central Taiwan above the Sun-Moon Lake (See map). The design and construction of this dam will be done with the technical assistance of the U. S. Bureau of Reclamation. It is scheduled for completion by the end of 1956. Beside its own capacity of 20,000 kw, it will provide additional storage capacity to the Sun-Moon Lake plant. Ten Chinese engineers will join the Bureau and work under its supervision for the job.

Need Being Met

Besides the potential water power of over 3.3 million kw which has been but slightly tapped, the island of Taiwan is also considered as a coal-producing region. With the exception of Kai-lo-pai mine in Hsinchu, which is just starting development now, the coal is of low grade. This coal can be efficiently burnt only in thermal power plants with boiler furnace specially designed for the purpose. A new oil well with an output surpassing all existing oil wells has recently been found and natural gas in small quantity has been obtained. Taiwan is abundant in power resources and the technical level of the engineers there is high.

The importance of the island has been enhanced since the Korean war. Because of its continuous industrialization, the island is becoming one of the most important centers of industrial and commercial activities in the Far East. After completion of the present projects, the island will have sufficient power for its present rate of industrialization. However, should industrial activity accelerate in the future, further power expansion may be necessary.





MODIFIED CIRCUIT represented in one-line diagram, left, shows resistance and inductive reactance of transformer and reactance of capacitor. Drying application, right, of capacitor circuit heat run uses capacitors in series with transformer to adjust impedance

Drying Large Transformers in Less Time

New modified short circuit has two advantages. Current can be varied to cut drying time, and power for heat run is available at extremely low power factor required

W. M. RODGERS, Power Transformer Department, General Electric Co, Pittsfield, Mass.

Larger transformers can now be dried in the field under a broader range of power conditions. The increased latitude results from a modification of the familiar short circuit heat run used in the factory to determine various thermal characteristics of a transformer. This basic circuit has been used for drying large units in the field because it is simpler, safer, and more economical to operate than air or external oil heaters.

The modified circuit discussed here, offers even greater advantages:

- Current can be varied to reduce drying time without added voltages.
- Power for the heat run is available at the extremely low power factor required.

Essentially the new circuit uses a capacitor bank to load the transformer. This arrangement effectively places the capacitors in series with the transformer windings. The capacitor bank can be adjusted to control the impedance of the transformer-capacitor combination so that a desired current can be obtained from almost any given voltage for drying.

Capacitors used in the earlier circuit to provide power factor correction offered no control of the current in the transformer.

It is also possible to use a delta connection of capacitors if the voltage rating of the capacitors is not exceeded. Delta connection requires only one third the capacitor units.

In using such a drying method, normal safety precautions should be observed. Capacitors should not be operated beyond the safety limits established by Nema Standards for Shunt Capacitors. Individual capacitors should be fused properly to clear the unit from the circuit in the event of failure.

How to Calculate Capacitors Needed For Drying

Assume a power transformer having the following rating:
Type OA-T-60 cycles — 25,000kva — 115,000GrY to 13,800v
Impedance Watts = 125 kw at 25,000 kva
%IZ = 8% at 25,000kva
Voltage available for drying = 220v, 3 phase
Capacitors available = 25 kvar, 7,960v each unit

To find capacitor arrangement needed to obtain 100% rated current:

$$IR_{per\ unit\ (pu)\ transformer} = \frac{125kw}{25{,}000kva} = .005$$

$$IX_{pu\ transformer} = .080$$

$$\text{Rated HV line current} = \frac{25{,}000kva}{\sqrt{3} \times 115kv} = 125.5\ amp$$

Applying voltage to LV, connecting capacitors to HV:

$$\text{Applied voltage}_{pu} = \frac{220v}{13{,}800v} = .0159$$

$$.0159 = \sqrt{(1.0 \times .005)^2 + (1.0 \times IX_{pu\ desired})^2} \qquad \text{(Eq. A)}$$

$$\text{Desired } IX_{pu} = \pm .0151$$

$$IX_{pu\ capacitors} = IX_{pu\ transformer} - IX_{pu\ desired} = .08 \pm .015 = .095 \text{ or } .065$$

$$\text{For the given capacitors } X_C = \frac{7{,}960v^2}{25{,}000va} = 2{,}530 \text{ ohms}$$

$$Z \text{ base HV} = \frac{115kv^2}{25Mva} = 530 \text{ ohms}$$

$$X_{C_{pu}} = \frac{2{,}530 \text{ ohms}}{530 \text{ ohms}} = 4.78$$

For a Y connection of capacitors, the number of units in parallel per phase for both lagging and leading power factor should be calculated.

$$N_{lag} = \frac{4.78}{.065} = 73.6 \text{ or } 74$$

$$N_{lead} = \frac{4.78}{.095} = 50.4 \text{ or } 50$$

$$\text{Voltage across capacitor} = 125.5 \times \frac{2{,}530}{50} =$$

6,350 volts < 7960v - (satisfactory)

$Z = .005 \pm j.015$, power factor = 0.314

$Kva = \sqrt{3} \times 220 \times 1{,}045 = 399kva$

$Kw = 399 \times 0.314 = 125kw$ = Impedance watts

In order to calculate the capacitors required for some value of current other than 100%, the values 1.0 should be replaced in equation (A) by the desired per unit current.

Easier, Quicker

SAFER HANDLING of Fuses, Switches, and Cutouts

Servicing SMD fuse with S&C Socket Fitting.

Installing a Liquid Fuse with a Locking Prong Tool.

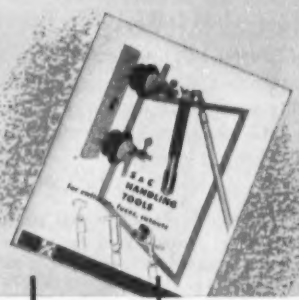
Now S&C Engineering provides better ways to handle fuses and to operate switches and cutouts. Whether out on the line or in the substation, the job can be done easier, more quickly, and safely with the newly designed S&C Handling Tools.

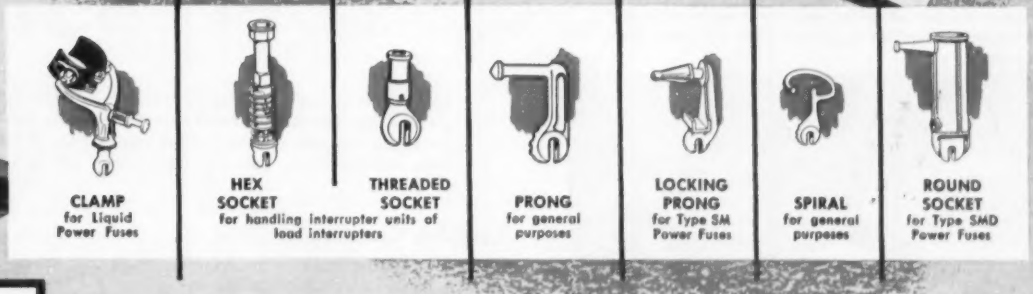
Tools of the past have usually been "jacks of all trades" (and masters of none). In contrast, each of these new handling tools has been designed as the answer to a particular problem; with the result that you get surer handling control—even in the dark or in a strong wind. For example, fuses hang in the best position for insertion, and feel lighter to the operator. They don't wobble or dangle annoyingly.

Tools have been developed to do jobs that were previously impossible. Replacing Type SMD power fuses, for instance, is now a simple, routine operation as shown at the left, and complete servicing can be done from the ground.

S&C Handling Tools, although planned to meet a particular problem, are so versatile in design that they may be used for handling switches, fuses, and cutouts of other makes. Note the illustrations below, which show that S&C Handling Tools consist of fittings designed for use with universal poles.

INFORMATION about the modern design features of S&C Handling Tools is contained in Catalog Section 823 . . . we will gladly send you a copy.





S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

IN CANADA:
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8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Specialists in High-Voltage Circuit Interruption

How L-M EEI-NEMA Fuse Links Give Best Coordination With Reclosers

by **R. W. KELLY**
Application Engineer
Protective and Switching
Equipment Division
Line Material Company

The introduction of dual timing in Kyle Reclosers opened a new field in coordination, and made possible the recloser-fuse coordinated systems. For a number of years, L-M "N"-rated Unifit links have done an excellent job of coordinating with reclosers. Today, through the use of L-M EEI-NEMA fuse links, the application of recloser-fuse systems has been further broadened.

Broader Range of Coordination

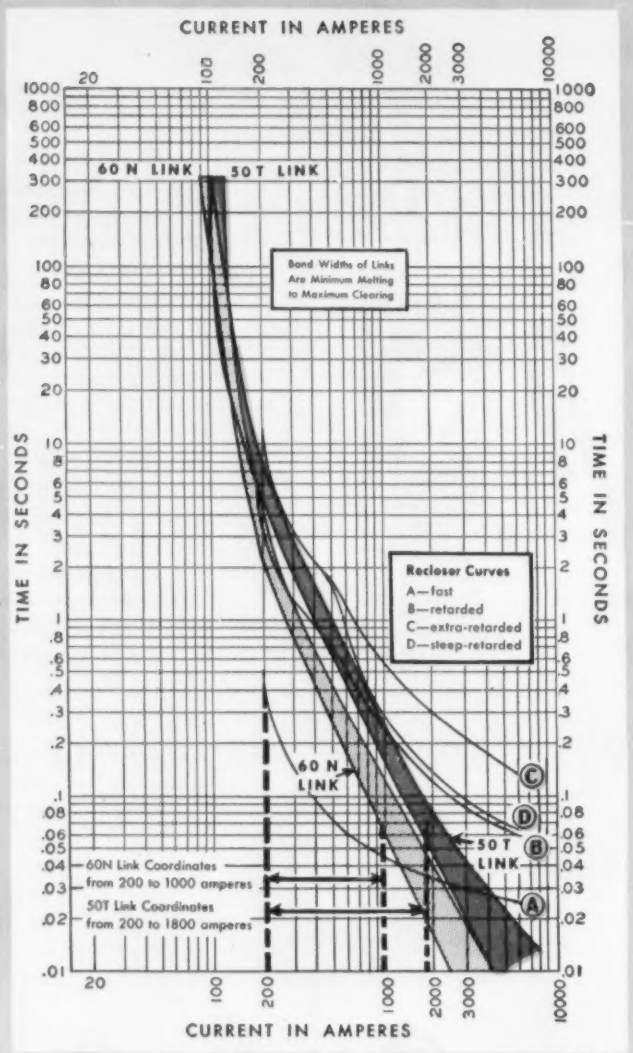
L-M EEI-NEMA links give a maximum range of coordination between reclosers and branch fuses. The improvement is illustrated by the example in the curves at the right, showing how EEI-NEMA links give even a broader range of coordination than the L-M "N" links.

Excellent coordination with reclosers is provided by both the L-M "T" and "K" EEI-NEMA links. The "T" link is particularly well suited because of its medium-slow characteristics. Yet it is not so slow that load current carrying ability is sacrificed.

L-M Links 100% Tested!

L-M EEI-NEMA links are made under close quality control. *Every* link is tested. It is subjected to a telltale resistance test, to check electrical accuracy. It is also given a 25-pound pull test to assure its mechanical strength.

L-M's CONVENIENT PACKING: L-M EEI-NEMA links come in handy 5-cell cartons. Each link is in a separate cell. Perforations make it easy to tear off one cell at a time, and to break off the end of the cell to remove the link. These cartons in turn are boxed for easy storeroom handling and distribution in 25-link packages and 100-, 150-, and 250-link cartons.



Comparison of time current curves of an L-M-Kyle type "L" 100-ampere recloser and 60N and 50T fuse links. The 60N links will coordinate in a range of from 200 amperes to 1000 amperes; the EEI-NEMA type "T" links will coordinate with the recloser from 200 to 1800 amperes.

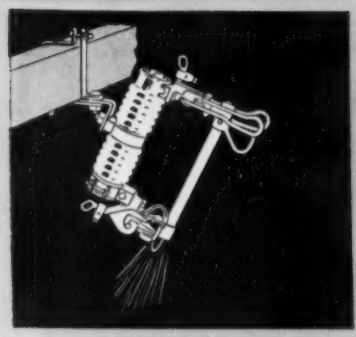
Complete Coordination Data

L-M makes available Bulletin FC5A on EEI-NEMA links, coordination tables, interchangeability tables for replacing "N" links of various makes, and a paper on the coordination of fuse links with reclosers.

Ask the L-M Field Engineer for copies of this literature; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

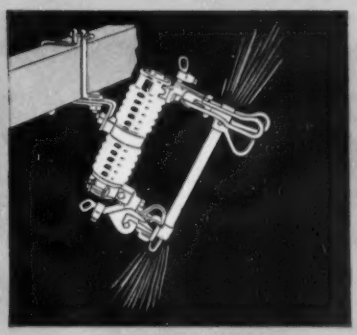
169

LINE MATERIAL
fuse cutouts and fuse links



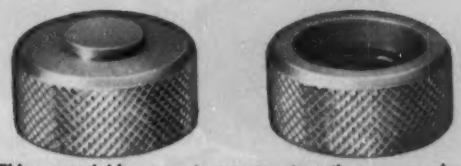
On Low Amperage Faults

single venting, at bottom only, provides ample pressure to expel the arc and the fuse link, before the tube drops down. In this case, only the fuse link needs to be replaced, not the cap.

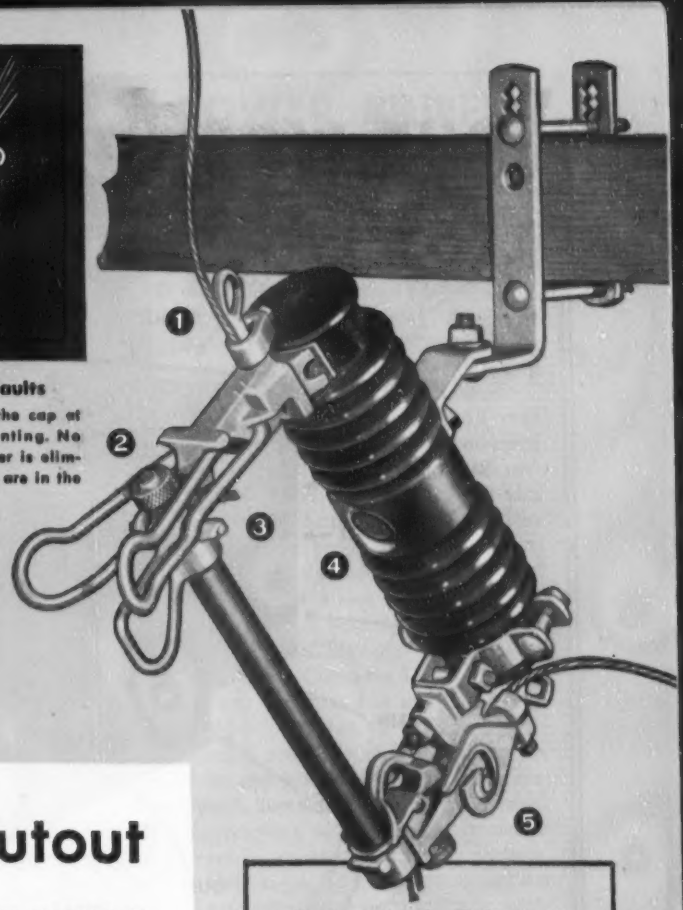


On High Amperage Faults

pressure automatically opens the cap at the top to provide double venting. No bursting of tubes. Gas flashover is eliminated because no cutout parts are in the path of gas discharge.



This expendable cap acts as an automatic escape valve. On low faults it remains undisturbed. On heavy faults the top opens, as shown at right, relieving the pressure.



L-M's "HCO" Fuse Cutout Provides 8000 Amperes Interrupting Capacity

For the first time, high interrupting capacity is available at low cost, in L-M's new open type distribution cutout. The increased interrupting capacity of the "HCO" is available at only about $3 more than the price of standard duty open type cutouts. This makes the "HCO" the lowest priced cutout of its type.

The "HCO" is ingeniously designed to handle both low amperage and high amperage faults equally well, with standard distribution fuse links.

This is accomplished by the automatic pressure-controlled expendable cap at the top of the tube. On low amperage faults, the cap remains intact, confining the pressure and providing bottom venting only. On high amperage faults, the diaphragm in the cap opens, relieving the pressure by providing double venting.

The "HCO" is completely bird-proof. The tube can be removed and replaced with the standard head hook-stick. It takes standard distribution fuse links.

Get details from the L-M Field Engineer; or write for Bulletin. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Rated at 5, 7.5, and 15 KV, 100 amperes.

NOTICE THESE FEATURES

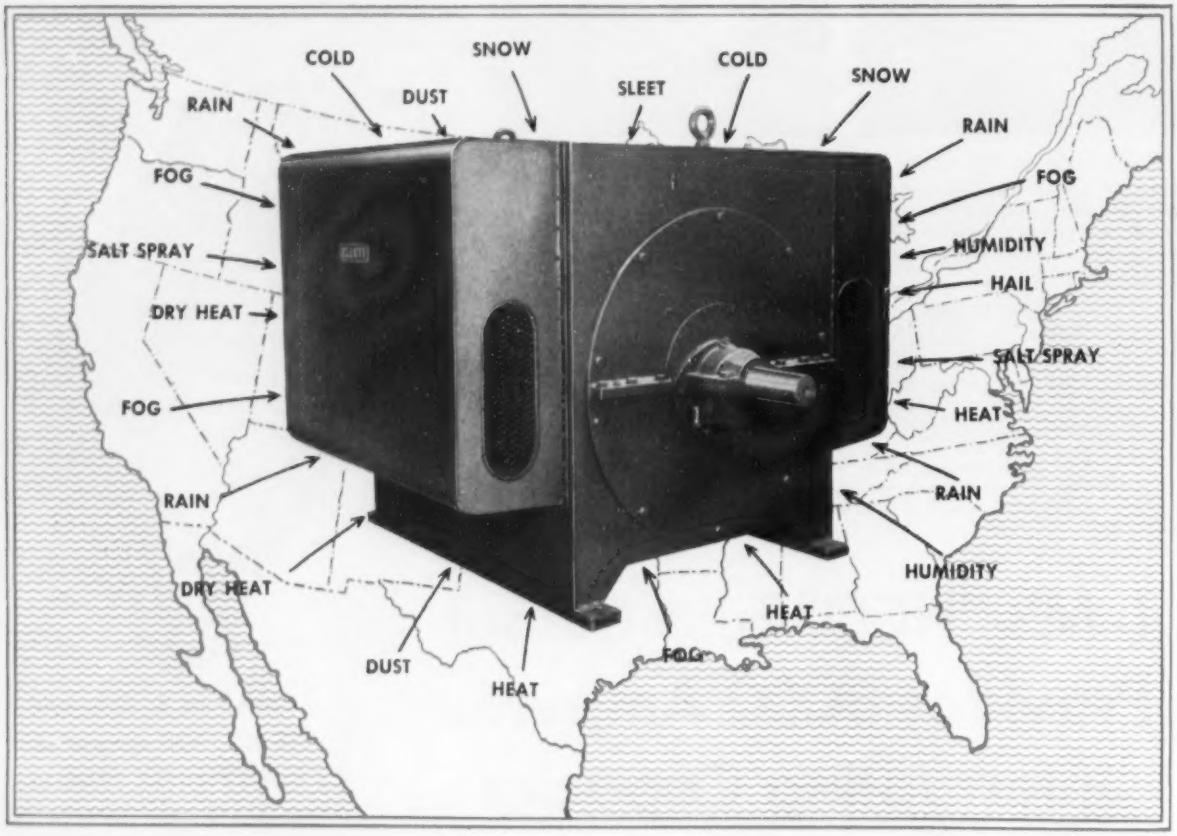
1. Rated at 5, 7.5, and 15 kv, 100 amperes, with 8000 amperes interrupting capacity using any size standard universal fuse links.
2. Expendable cap acts as automatic pressure-controlled vent to provide double venting on high amperage faults.
3. All current-carrying parts are silver plated.
4. Completely bird-proof design.
5. Heavy, closely fitted L-M—patented double hinge takes all the recoil forces. Top contacts not stressed by recoil. In reclosing, the hinge guides the tube directly between the contacts—it can't miss the top contacts.

The expendable caps, replaced only when the link blows on a *high* amperage fault, are economical, easily replaced. They are supplied in a cloth bag, carried with the fuse links.

LINE MATERIAL

fuse cutouts and fuse links

Your weather is no problem!



Here's an economical splashproof motor you can install outdoors with no protection beyond that provided in its own structure.

ELLIOTT *OUTDOOR SPLASHPROOF WEATHER-PROTECTED* MOTOR

Have you a power problem that could be most easily met by an outdoor motor? This Elliott motor has proven the economical answer in many installations previously requiring more expensive designs. We call it Outdoor Splashproof. But it is much more than that. It's protected against all kinds of weather — immune to temperatures from 120 above to 40 below. Defying blizzards, torrents of driving rain, dust, fog and salt spray. Protected even against the intrusion of vermin, wild life, leaves and trash. Your nearest Elliott district office will give you full details, or write Elliott Company, Ridgway, Pa.

Elliott FABRI-STEEL MOTORS AND GENERATORS

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

RIDGWAY DIVISION

FOR MOTORS 1-200 HP: CROCKER WHEELER DIV. AMPERE, N. J.

R3-32

SPEAKERS at recent Interstate Power Club meeting are pictured with club's chairman. They are (left to right): John B. Taylor, Atlantic City Electric Co; R. W. Wyman, Cleveland Electric Illuminating Co; John H. MacNeal, Consolidated Edison Co, chairman of the power club; Walter H. Sammis, Ohio Edison Co; and J. M. Stedman, Pennsylvania Power & Light Co

Higher Power Sales Possible . . .

. . . Sammis tells Interstate Power Club. EEI head says economic readjustment offers utilities an industrial selling opportunity

The present economic readjustment offers an excellent opportunity for utility power sales. This was the message of Walter H. Sammis, president of Ohio Edison Co and Edison Electric Institute, in addressing almost 100 power salesmen at Interstate Power Club meeting March 10 in New York.

Production Costs a Factor . . . Sammis said that utilities' industrial customers look more closely at production costs when there are indications of a falling off in business. But, he pointed out, it is up to the power salesmen to see that the customers know that the completely electrified plant is the low-cost plant that keeps operating year in and year out. He urged the group to "dust off" the production methods analysis section of the EEI Power Sales Manual and apply the principles.

The improvement of annual load factor is the most effective foreseeable way to hold utility plant investment within present limits, John B. Taylor, vice president of Atlantic City Electric Co, declared. Taylor described a relatively simple method of forecasting with a reasonable degree of accuracy the results of sales efforts from the normal sales reports. From this data, he said, his company is able to predetermine the results of expected sales in terms of added system peak load, kilowatt hours, and estimated annual revenue. Taylor stated that a properly planned sales program will result in increased net revenue, lower rates, better satisfied customers, less competition and more service to the communities served.

J. M. Stedman, Pennsylvania Power & Light Co declared the challenge to sell today has greater insistence than ever before and its urgency will increase. He said utilities are going to have to sell as they have not sold in a long time. The sales effort has to be far-sighted, inspired and, most important of all, it has to be continuous and energetic. Stedman declared that the time is again with us when the consumer's propensity to spend depends on creative sales and promotion men.

R. W. Wyman, Cleveland Electric Illuminating Co, outlined the industrial sales program of his company. He stated that a few of the goals established are: $100,000 per man ($300,000 per man on special accounts), six calls per man day and eight miles per call. Wyman said that the days of order taking are over and that power salesmen are going to have to "roll in high gear."

POWER BRIEFS

● Harvard Law School expects to make a study of laws and administrative systems governing electric power operations in underdeveloped areas throughout the world. The study, to be undertaken for the International Bank for Reconstruction and Development, will emphasize the problem of financing capital expansion.

● New Zealand's Minister of Works W. Stanley Goosman has announced that the building of the first geothermal power station at Wairakei will have priority over the last of the hydroelectric projects on the Waikato River. That thermal region is expected to become a major source of power supply in the near future, according to the Works Minister.

● British Columbia Lands Minister Robert Sommers has unveiled a $1,860,000,000 plan to develop hydroelectric resources of the Fraser, Yukon, and North Thompson River systems. Sommers said the provincial government was confident it would have no trouble financing the projects, which range from an $800 million hydro installation on the Fraser River to flood-control facilities in the Fraser Valley.

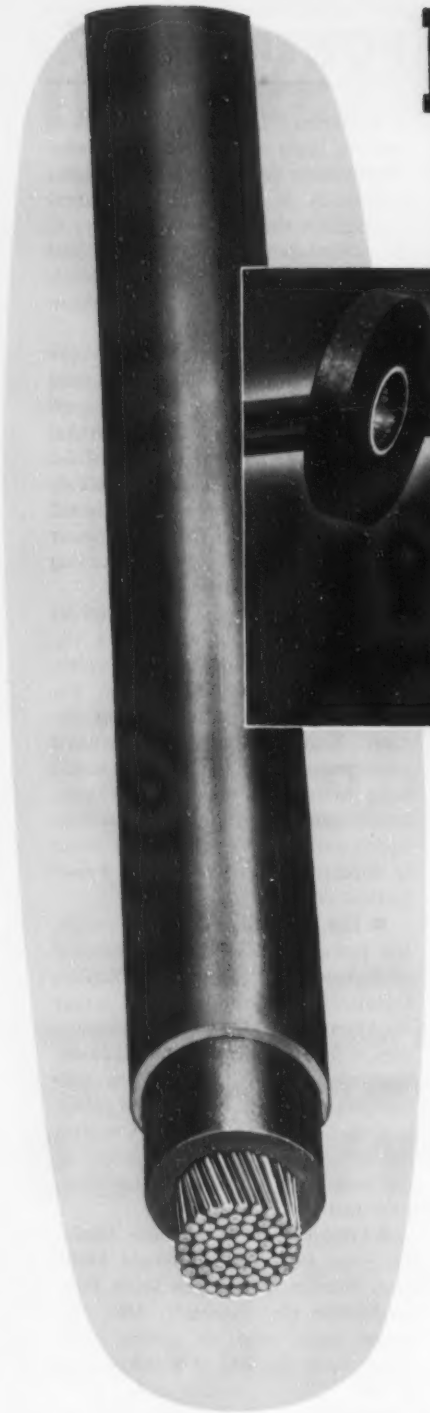
● The memory of Albert L. Cole, late power production superintendent of Saskatchewan Power Corp, Regina, Canada, and former editorial writer for "Power," a McGraw-Hill publication, will be perpetuated in Saskatoon, Saskatchewan, by renaming the utility's power plant in that city the Albert L. Cole Generating Station. A memorial library also will be established in the company's Regina office for Cole, who died in 1952.

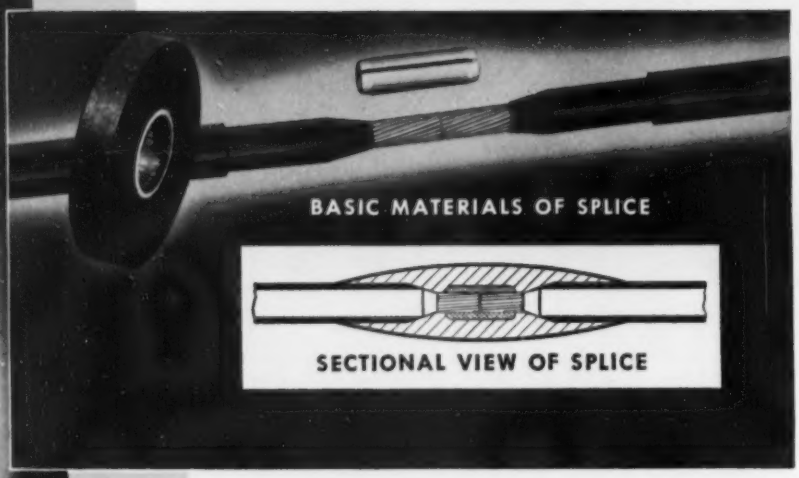
● Edison Electric Institute Medal has been awarded to Edward Hoffman, lineman for Eastern Shore Public Service Co, Salisbury, Md., for rescue work atop an electric pole which saved the life of a fellow employee.

● University of Wisconsin has accepted a $10,000 grant from the Wisconsin Alumni Research Foundation to permit the university to participate in a plan of seven Midwestern universities to obtain financial support for a proposed cosmotron to be used for basic research in high energy atomic physics. Construction of the 15-30 billion v cosmotron is estimated to cost between $15 and $30 million dollars.

Rome RoZone®

Superior Ozone-Resistant Insulation Deserves Your CONFIDENCE





What its Ease of Installation Means to You

Q: **Where can RoZone insulated cable be installed?**

A: It is successfully installed in any location, whether direct in earth, in conduit, in racks, overhead or in combination runs.

Q: **How is RoZone spliced and terminated?**

A: Splicing and terminating can be accomplished by simple manual methods that have been time proven—require little experience. No potheads are necessary. It is easy to strip, clean to handle.

Q: **Why are fewer splices required with RoZone?**

A: It can be manufactured in longer lengths and its light weight makes it possible to pull these lengths easily. As a nonmetallic sheathed cable, it does not require special lubricants.

Q: **Can RoZone be joined to other types of cables?**

A: Yes. By proper splicing techniques, RoZone may be joined to most other types of cable.

Ease of installation, combined with exceptional resistance to aging, corona, and ozone cutting plus low dielectric loss and excellent electrical stability in water, is why RoZone deserves your confidence. For complete information, send for the Rome Power and Control Cable Catalog.

It Costs Less to Buy the Best

RoZone is approved and accepted by leading utilities, industrials and consulting engineers

ROME CABLE
Corporation
ROME • NEW YORK
and
TORRANCE • CALIFORNIA

ROME CABLE ROME, N.Y.

IEC's 50th Parley

Golden jubilee meeting of International Electrotechnical Commission set for Sept. 1-16

The fiftieth anniversary meeting of the International Electrotechnical Commission (IEC) will be attended by 700 electrical technical experts from 29 countries and the U. S. when it convenes on the campus of the University of Pennsylvania, Philadelphia, Sept. 1-16. Announcement of the meeting was made by American Standards Association, the group through which U. S. participation in the event is being carried on.

Delegates will hold 226 morning and afternoon sessions in which they will work on international standards in the fields of electric light, power, and communications.

About 26 of IEC's 37 technical committees will hold sessions in Philadelphia. The United States heads the following five committees: Steam and hydraulic turbines, internal combustion engines, letter symbols and signs, and lightning arrestors.

Topics to Be Discussed . . . Tentative schedule of the meetings of the different committees calls for sessions to be held on these subjects: Classification of insulating materials, low voltage switchgear, switchgear and control gear, electrical installations in ships, electric and magnetic magnitudes and units, lamps, lamp caps, and holders.

To commemorate 50 years of IEC, an all-day jubilee celebration is scheduled for Sept. 9 in the auditorium of the University Museum. That evening a golden jubilee banquet will be held at the Bellevue Stratford Hotel.

IEC president is Dr Harold S. Osborne, formerly chief engineer of the American Telephone and Telegraph Co. Richard C. Sogge, General Electric Co, is president of the U. S. National Committee of IEC. P. H. Chase, Philadelphia Electric Co, is chairman of the general committee in charge of arrangements.

Commission Founded in 1904 . . . IEC was founded in St. Louis in 1904 with Sir William Thomson of England serving as its first president. First and only meeting held in the U. S. took place in New York in 1926. Other meetings have been held since World War II in various cities in Europe.

Promoting Bigger Loads on Rural Lines

Cooperation was the theme of the Rural Electrification Administration Power Use Conference held March 11-12 in Chicago. Among those taking part in the conference's mutual problem talks were (left to right) R. W. McClure, vice president, Kansas Power & Light Co; Ancher Nelsen, REA administrator; Clyde T. Ellis, executive manager, National Rural Electric Cooperative Association; and H. S. Bennion, managing director, Edison Electric Institute.

Fred H. Strong, assistant administrator of REA, presided at the meeting which was designed to initiate joint action leading to greater use of electricity in rural America. Greater power sales in rural areas was cited by McClure as a means of enabling co-ops to obtain loans from REA and utilities from banks.

Nelsen declared that because of REA's repayment schedule, the debt service schedule of many co-ops would reach a peak within next few years. For this reason, he said, many co-ops will find themselves barely on the borderline of meeting debt service. Nelsen said solution lies in selling more appliances and therefore more electricity.

Construction Firm Files Claims Suit Against TVA

McDowell & McDowell Construction Co, Nashville, Tenn., has filed suit in federal court for $59,390.55 it claims is due from the Tennessee Valley Authority as "extra compensation" for work performed at the Gallatin steam plant project last year.

The complaint, filed by the firm's attorney J. Olin White with the U. S. District court clerk, alleges the TVA "misrepresented" itself as to the level of rock formation which was excavated by the construction company, causing the firm "great additional expenses . . . and delay in the excavation."

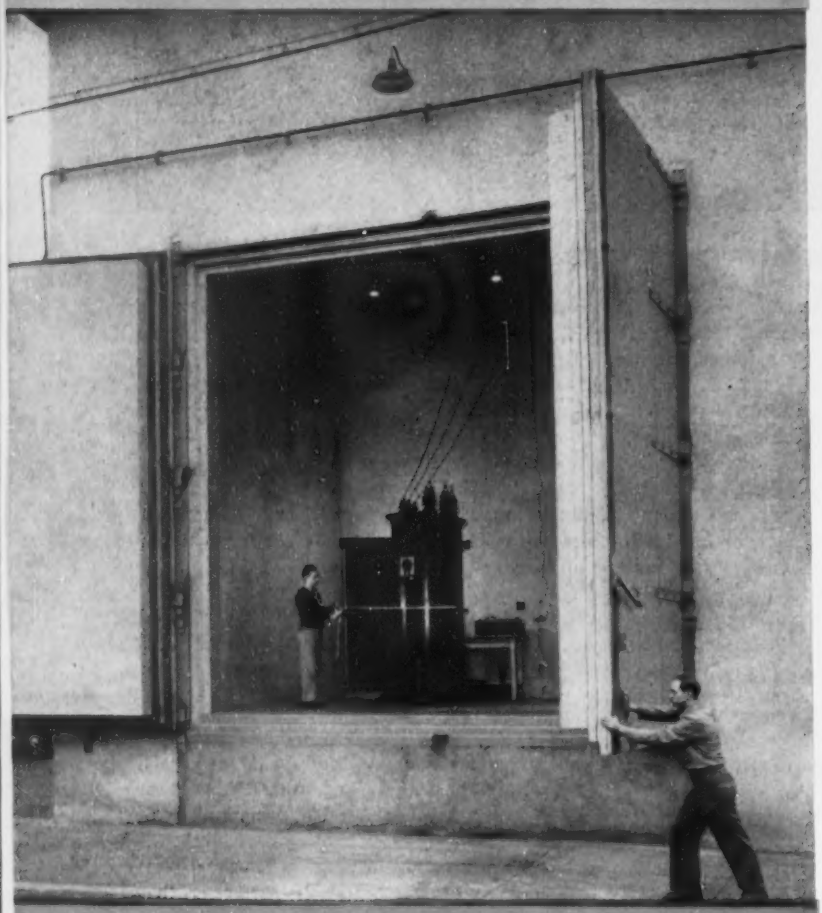
Roscoe B. McDowell, Roscoe B. McDowell Jr, Charles W. McDowell, and Robert A. McDowell, principals in the suit, claimed that "the plans, drawings, data and information" provided by TVA "showed rock level . . . to be at one level . . . whereas" it was found to be nearer the surface of the ground than set forth.

The firm was awarded a contract in September, 1952, to construct roads, railroads, rights-of-way and a steam generating plant at the Gallatin project in Sumner County. Robert McDowell Jr, said the work was started in May, 1953, and completed in December.

The suit said after the rock level was found to be different from what was anticipated, the firm informed TVA of the discrepancy but the "defendant declined and refused to pay."

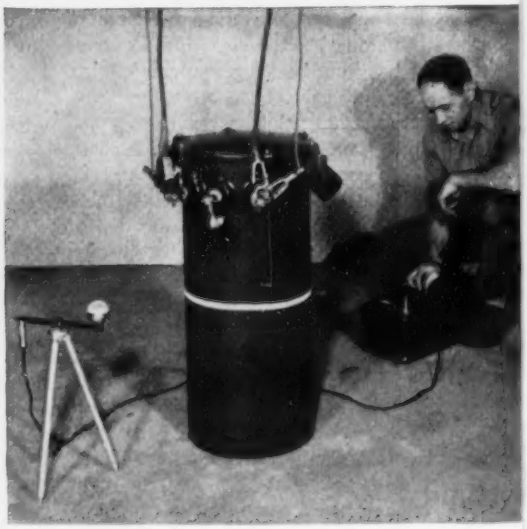
A Quiet Transformer Makes

Allis-Chalmers sound laboratory has been the proving ground for making good neighbors. Constant research in magnetostriction and resonance gives clues to better design.



Huge doors lock out external noise after transformer is in position for testing. Allis-Chalmers sound laboratory has been in use since 1949.

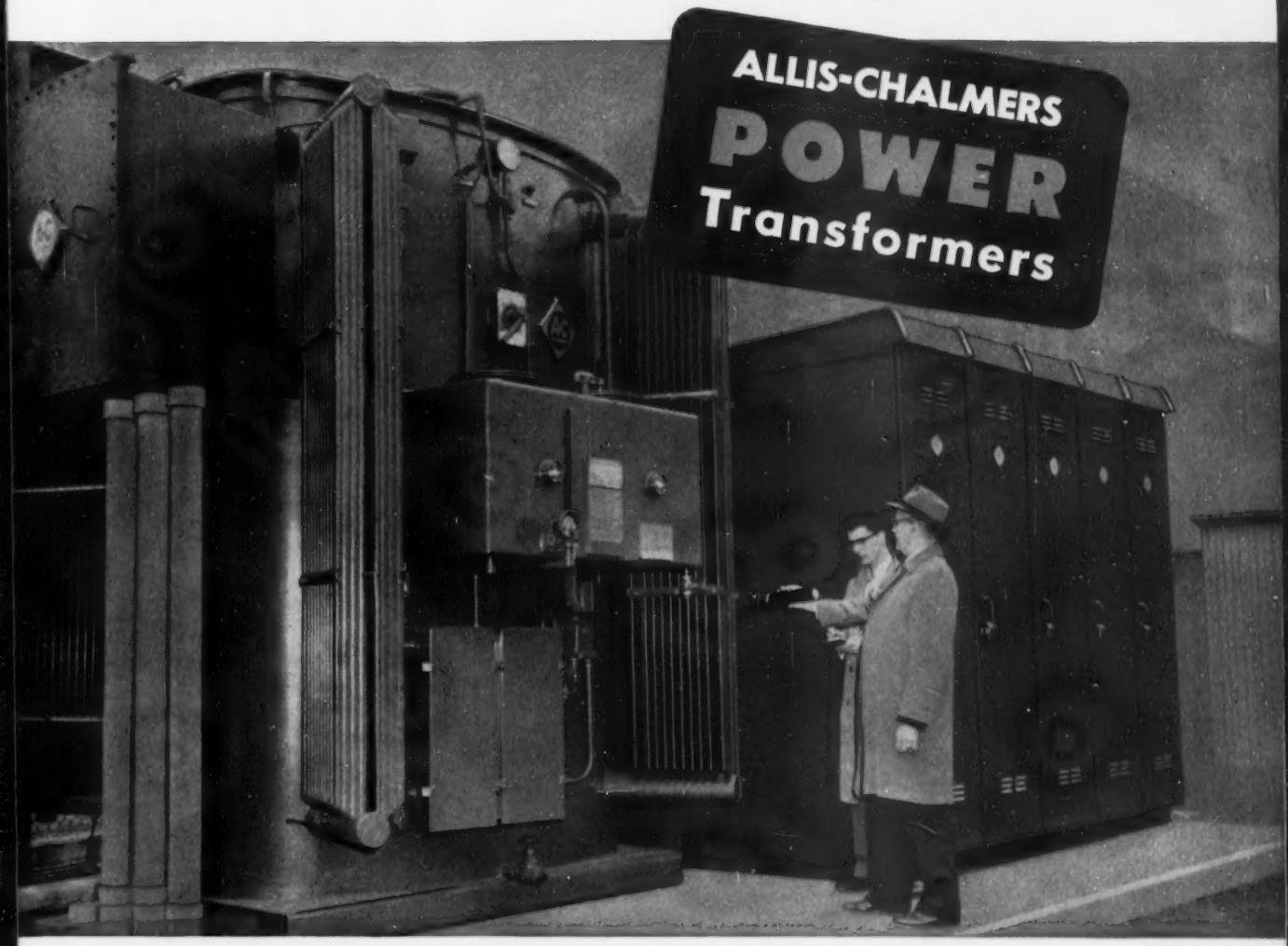
Analyzing noise for harmonic content on a 1000 kva transformer. Ambient noise level of laboratory is 28 d.b., a reduction of approximately 42 d.b. from level of outside noises.



A distribution transformer gets audio sound level tests. Physical noise level testing instruments and harmonic index are new tools in the measurement of sound energy.

ALLIS-

a Good Neighbor



Good neighbors are quiet neighbors. To help utilities become welcome neighbors in residential and commercial areas, Allis-Chalmers has been applying to its transformers and substations the lessons learned in its large sound laboratory, which was placed in operation in 1949.

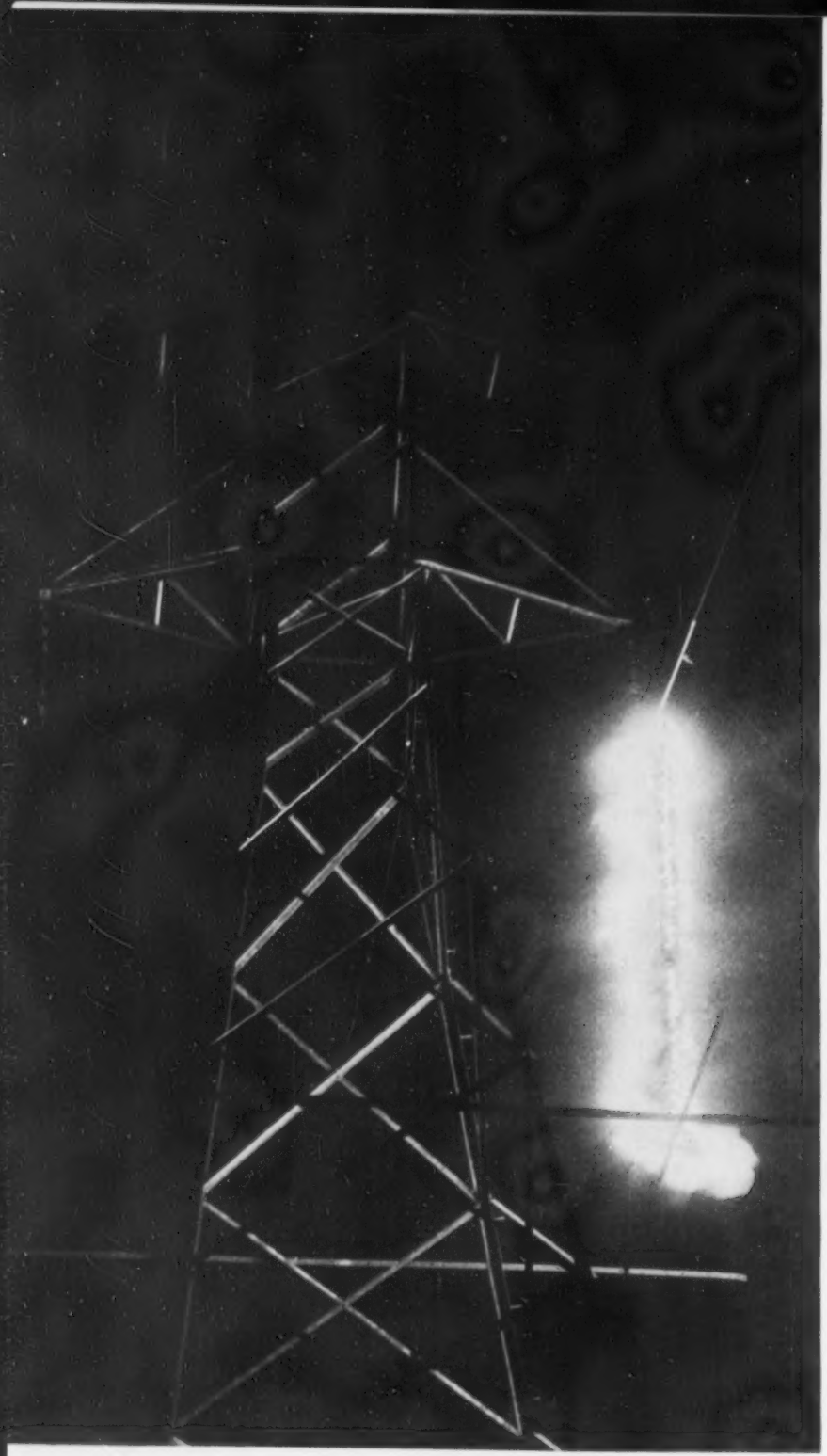
The laboratory houses modern, complex equipment for accurate audio sound measurement within two-foot thick walls of concrete, glass wool and acoustical tile. The sound laboratory has its own foundation and is removed from any manufacturing disturbances.

Intensive research, now in its fifth year, has resulted in uniformly quiet transformers throughout the range of sizes constructed. Proof comes in the field when tests show reduced sound levels on transformers like the one pictured above.

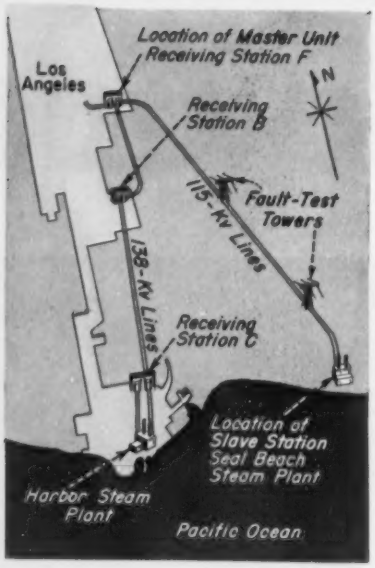
Thanks to this constant research carried out by Allis-Chalmers, you get a transformer that is the best kind of neighbor available. A-4196

CHALMERS

MILWAUKEE 1, WISCONSIN



All-electronic fault locator passes field tests on Los Angeles Dept of Water & Power 115-kv transmission line. Towers selected for test were about one third of the distance from each end of the 23-mile line



Staged Faults Are Traced

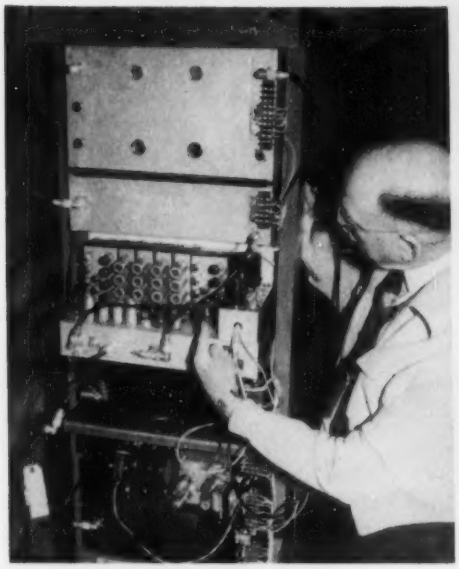
Locates

An all-electronic system, continuously monitoring an energized transmission line, has located faults accurately in recent field tests on the Transmission System of Los Angeles Department of Water & Power. The new system localized simulated faults to the exact tower on a 23-mile stretch of 115-kv line, although the designed accuracy calls only for location within about ±1,000 ft. Field tests on the Pacific Gas & Electric Co 220-kv lines were conducted March 28.

On the test line between Seal Beach Steam Plant and Receiving Station F several faults were applied to two towers, each about one-third of the distance from the opposite ends of the line.

Fault Tests Simple . . . Four 20-ft lengths of No. 24 iron wire, each with a 2-lb weight, were attached over the armor rod on the lowest phase conductor while the line was de-energized. The wires, spaced about 3 ft apart and away from the insulator string, were pulled away from the tower by lengths of string to an angle of about 30 deg.

When the line was energized, mobile radio coordinated the release of the wires one at a time with operations at both ends of the line. The



by Electronic Master . . .

and Slave Units of New System That . . .

Faults on Live Transmission Line

wires fell against and shorted to a horizontal grounding bar attached to the tower to prevent damage.

Criterion for successful operation of the electronic fault locator was its ability to measure accurately the time in micro-seconds for the traveling fault wave to reach the line's end. By referring the time to a specially calibrated chart, the point of fault can be located within ±984 ft, approximate distance an electric wave travels in 1 micro-sec. A 1-micro-sec error is tolerable.

System Components . . . The electronic system has a master station on one end of the line and a slave station at the other. The master station includes a 100-kc transmitter, a micro-second counter, a 1-mc temperature-controlled crystal oscillator, and a fault receiver.

Slave station equipment is the same, except that it includes a 100-kc synchronizing unit instead of the transmitter. Both stations connect to the transmission circuit through standard high-voltage coupling capacitors.

Synchronizing Counters . . . The method of synchronizing insures that counters at both stations operate at the same speed. The transmitter is driven from the oscillator by a 100-kc signal free of modulations. The 100-kc output is received at the slave station over a narrow-band receiver and fed into one side of the synchronizing unit. Fed into the other side is a 100-kc signal driven from the slave station oscillator. The synchronizing unit compares the two signals and acts to hold the slave station oscillator in phase with the master station unit.

Transmitter output is kept at a low value, between 15 and 20% of normal for synchronizing. With both counters set at zero and inactive, operation of the start button at the master station allows transmitter output to increase gradually to full power. When a certain output level is reached, a pulse is generated that energizes the master counter. Operation of the slave counter in the same manner begins a short time later, depending on the line distance between stations.

Normal Operation . . . During normal operation, both counters run at exactly the same speed, with a difference in micro-seconds representing travel time along the line. When the transmission circuit is faulted, the traveling wave is received by each fault receiver which generates a pulse that stops its counter and gives a visual and audible alarm.

Operators at each station report the reading of the counters to the dispatcher. By referring to the calibration chart, the dispatcher determines the location of the fault. Counters may then be re-started.

Protection . . . The electronic locator is designed primarily for circuits that may experience heavy currents along with low-resistance faults. While it is especially applicable to circuits of 100 kv and greater, it may be used on 60-kv lines that have no intermediate stations. As it can protect lines for about 300 miles, it should be applicable to all existing lines in the country.

Where two or more transmission lines are parallel for their total distance, only one set of locator equipment is needed. Multiple connections to all circuits may be made through capacitor couplings. In such applications the fault locator gives distance, and the circuit breaker relays indicate the line tripped. Application of the device must be preceded by a calibration test. The full effect of line taps on calibration is under study. The Seal Beach-Station F test circuit is not tapped but has the equivalent of two taps through its terminal connections.

Selecting a Safety Slogan

Potomac Edison System competition draws entries from 10% of the employees, directs attention to the problem

RAYMOND E. BEARD, Safety Supervisor, Potomac Edison Co, Hagerstown, Md.

"Think Safety More in '54."

That is the slogan over 2,000 Potomac Edison System employees will keep in mind this year as they perform their duties for the four system companies.

They are not likely to forget it because the slogan was the winning entry in a company contest which drew nearly 600 entries from about 10% of the employees.

In establishing the contest the company had as its primary purpose the making of employees more safety conscious. The securing of a short, easily remembered slogan was secondary.

Rules Were Simple . . . Contest rules were simple and brief:

- Slogan shall be six words or less.
- One world shall be "fifty-four" spelled out or in figures.
- Decision of the judges is final.
- All entries become the property of the company.

A prize of $25 was offered with duplicate prizes in case of a tie.

The judges—one from each of the company's major departments, operations, commercial, and power production—narrowed the entries down to seven. Three were "Think of Safety More in '54." The other four were "Think Safety More in '54." The word "of" was the only difference. The final decision was to give all seven contestants a $25 award and to use the shorter slogan.

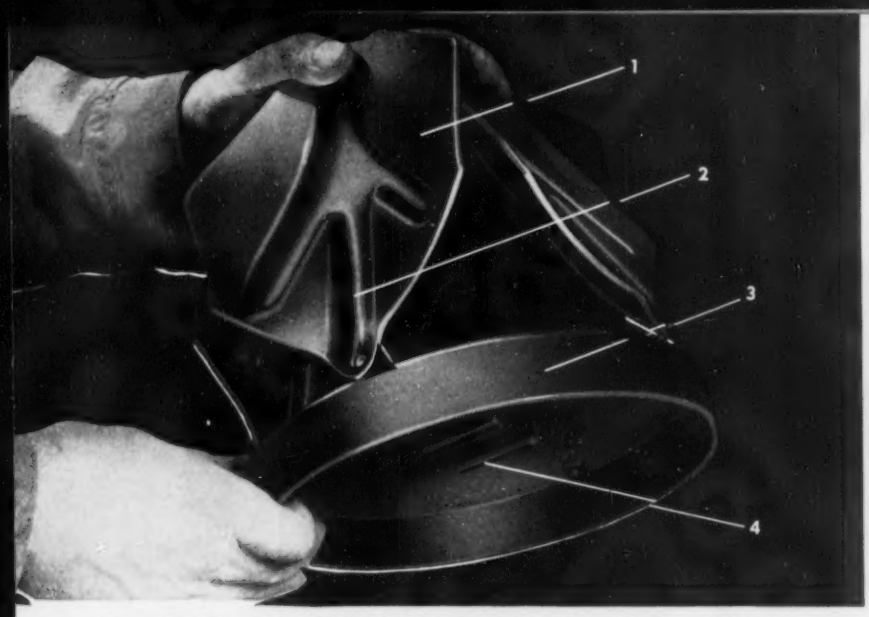
The company felt, however, that this additional money was well-spent. Instead of having a winner from one location, there were seven winners from five different operational areas of the system.

"It cost us more than we figured on," one company official said, "but we got our employees thinking about safety—that's money well spent."

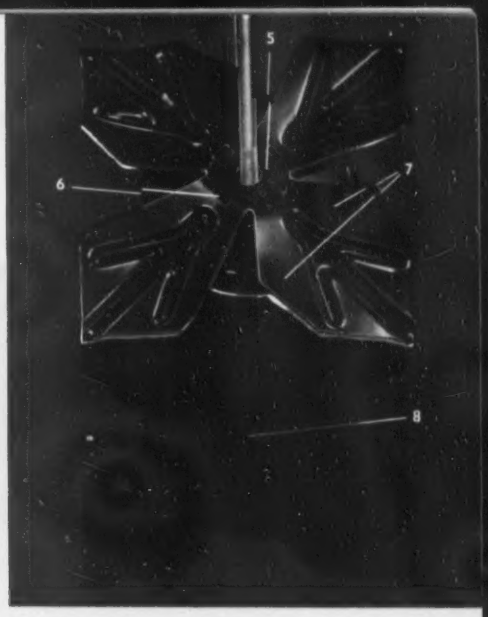
These girls teamed up on an entry . . .

. . . but failed to win over judges who selected . . .

. . . seven winners, all males, including the three on the right



Heavy, shovel-shaped blades (1) slide into the earth with minimum disturbance. Ribs (2) on the underside stiffen the blades and cut friction against base. Heavy domed base plate (3) with deep skirt for strength. Nut retainer channel section (4) welded to the underside of base keeps the rod from pulling the nut through the base.



Note the large, square tamping area (5) and the wide hinged sections (6) which keep the blades from twisting if a stone is encountered while the anchor is being expanded. "Ears" (7) inside the center of gravity of two opposed blades give additional area for holding power, better balance. (8) "Projected Area," as L-M figures it, is the area of the *shadow* cast by the expanded anchor, not the total surface area of the plates including vertical sides of ribs as usually figured.

Tests Show L-M Anchors Have High Strength, Minimum Creep

The value of an anchor depends both on its inherent strength, and on its ability to resist creep. You can realize the importance of creep better if you take an actual example. Let us suppose a line built with 35-foot poles at 200-foot span, and 8-inch sag. If an anchor guyed at 60 degrees had a 4-inch creep, the resulting sag would be 86 inches! No wonder utility men are cautious about creep!

Design Based on Extensive Tests

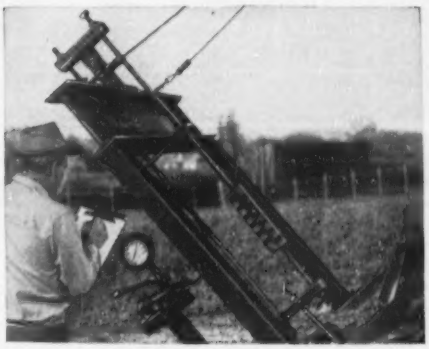
The design of L-M 4-way expanding anchors is based on a very extensive series of pull tests. As shown in the small photo, anchors were buried, and pulled with a hydraulic lift, till the anchors gave or the rods broke. One after another, weak points were eliminated, and the anchor was redesigned to cut creepage.

The features shown in the illustrations are the result of this test program. We feel this L-M anchor is the finest you can get. It assures the greatest strength with minimum creepage.

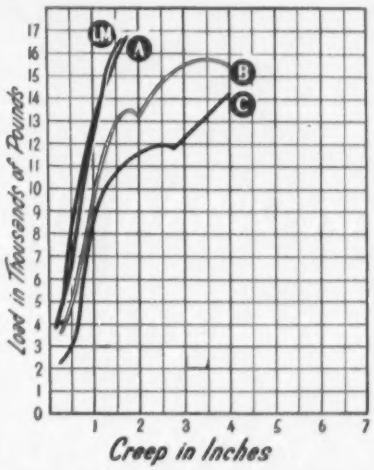
The four blades are formed of a single piece of steel, shaped, and held to the base by four small bolts that shear off easily by tamping.

Ask the L-M Field Engineer

For catalog information and samples if you wish, ask the L-M Field Engineer who calls on you; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division). 116



Pull Test Equipment: Hydraulic lift on U-shaped steel frame with pump and pressure gauge for recording the pounds of pull applied to anchor rod. Tests were made both at vertical and at 45 degree angles.



In tests with 3 comparable anchors the L-M-designed anchors held creepage to a minimum, even at loads of 17,000 pounds.

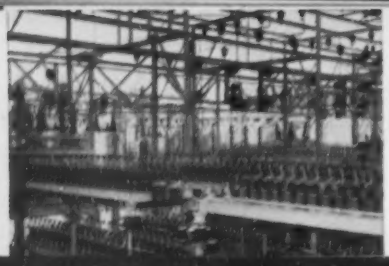
Available in 3 Sizes

Catalog Number	Diameter—Closed—Inches	Expanded Area—Square Inches	Nominal Holding Power Class—Pounds	Anchor Rod Diameter—Inches	Minimum Mechanical Strengths Without Noticeable Deformation—Pounds
200026B1	8	110	6,000	⅝, ¾	16,000
200026B2	8	125	8,000	⅝, ¾	21,000
200026B3	8	132	10,000	1	24,000
200026B4	8	132	10,000	⅝, ¾	24,000

All 3 sizes are REA-approved, and have been thoroughly tested by both L-M and by utility companies. You can depend on them to hold!

LINE MATERIAL

Line Construction Materials



L-M's New VDS Method

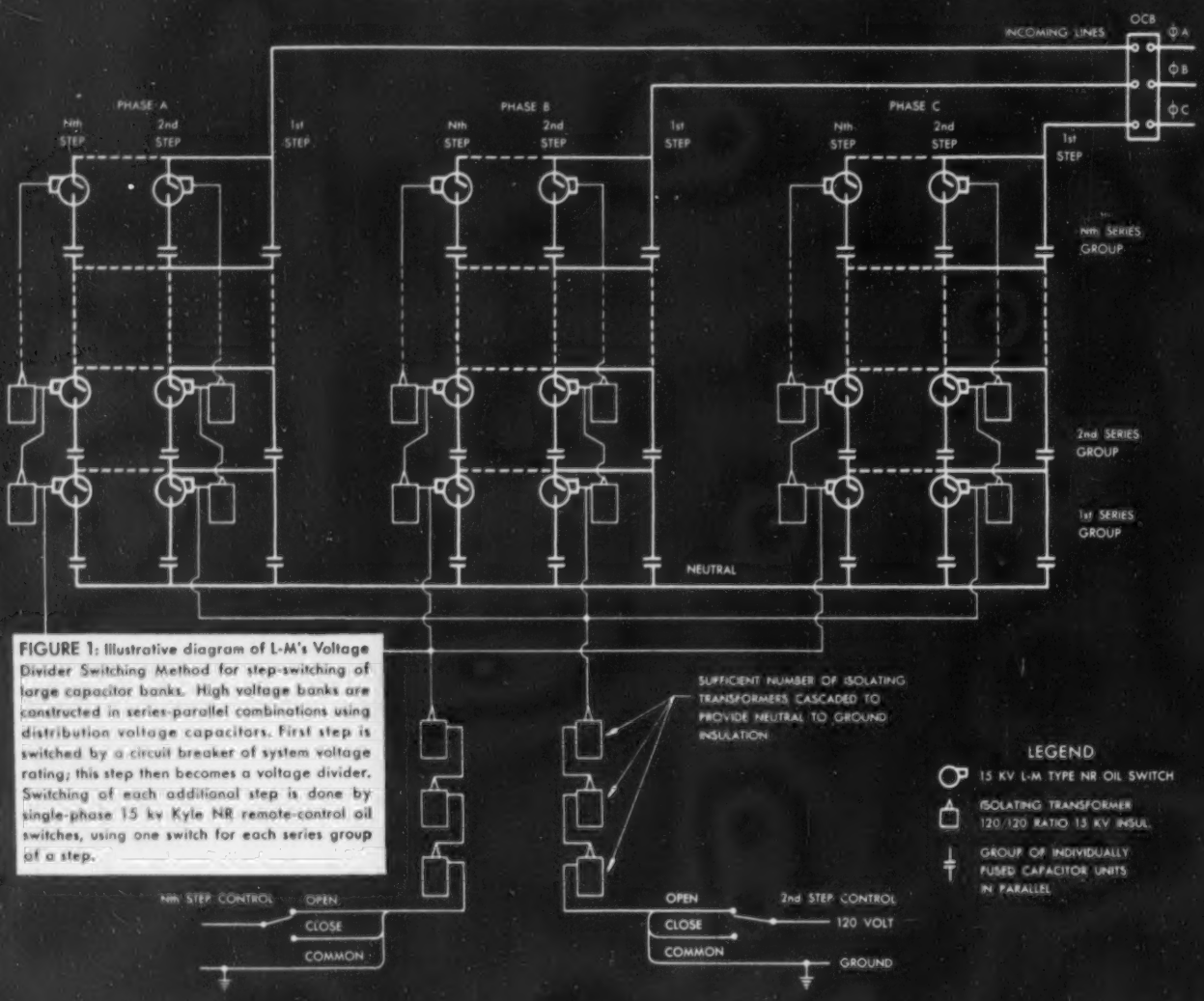
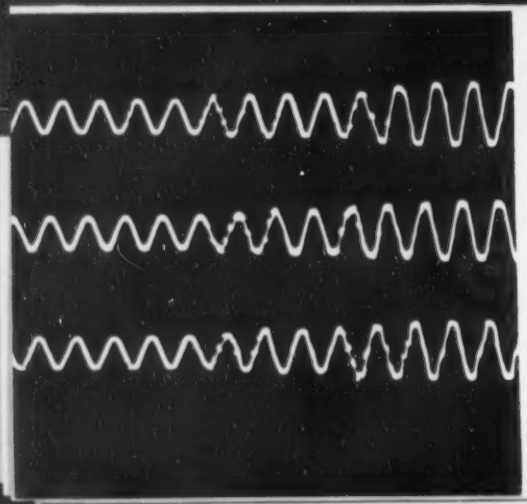
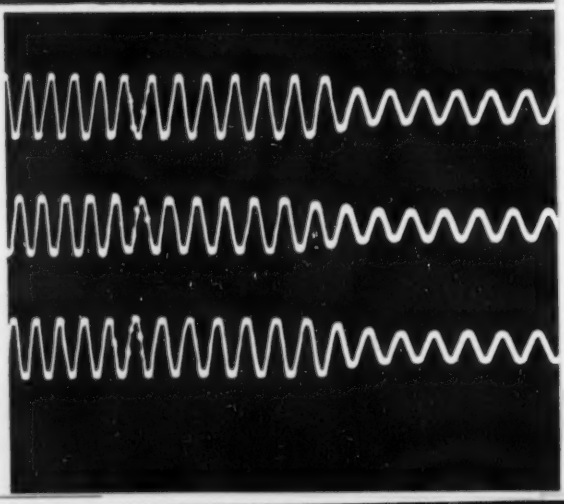


FIGURE 1: Illustrative diagram of L-M's Voltage Divider Switching Method for step-switching of large capacitor banks. High voltage banks are constructed in series-parallel combinations using distribution voltage capacitors. First step is switched by a circuit breaker of system voltage rating; this step then becomes a voltage divider. Switching of each additional step is done by single-phase 15 kv Kyle NR remote-control oil switches, using one switch for each series group of a step.





Oscillograms show that the random operation of a number of switches, all within approximately ½ second, eliminates any system disturbance. Figures 2 and 3 show the switching on and off of a 5250 kvar step of capacitors at 46 kv by 21 Kyle oil switches comprising seven series groups per phase. The current increases or decreases smoothly as the 21 switches operate at random times.

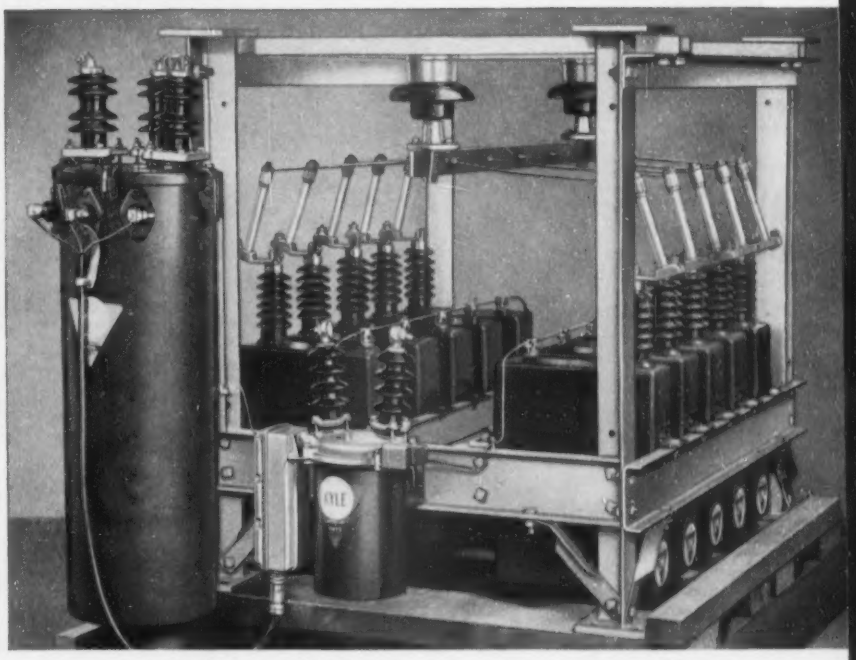
FIGURE 2—ON

FIGURE 3—OFF

Cuts Capacitor Switching Costs 40%

L-M develops low-cost method of switching large multi-step capacitor banks. Known as the Voltage Divider Switching Method (patent applied for), this method permits substituting low-cost 15 kv oil switches for circuit breakers on all but the first step of multi-step banks from 23 to 230 kv.

by **P. M. MINDER**
Application Engineer
Line Material Company



L-M's new factory-assembled stacking unit. The unit includes ten or more 25 kvar capacitors and the required fuses, Kyle NR switches, and isolating transformers mounted on the end of the frame. These stacking units are available in sizes from 250 to 600 kvar.

With the trend toward installation of capacitors on transmission and subtransmission circuits, capacitor switching has become a problem of economics. Large banks sometimes must be switched in a number of steps. The conventional practice requires a large breaker for each step. Thus the cost of switchgear for these large multi-step banks may become prohibitive.

L-M's Voltage Divider Switching Method utilizes L-M's Kyle NR remote-control 15 kv oil switches on all but the first step of a large bank. While a number of these switches are required, they cost only about $100 each, and even a number of them cost far less than a large breaker.

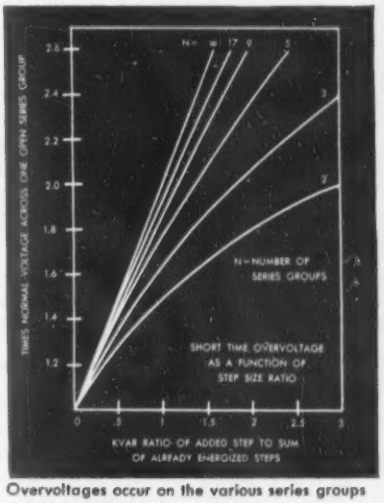
Cost Cut 40%, For Example

Here is an example of the comparative cost of switching by the conventional method and the VDS Method. Figures are based on a bank rated at 69 kv, 15,750 kvar, with 3 steps, each 5250 kvar.

Figures include cost of switching equipment only. They do not include cost of automatic control equipment in either case. Nor do they include cost of installation, or the saving in foundations for two additional large breakers. It is evident that, in any case, the use of the VDS Method offers substantial savings. Discussion with one of the L-M Field Engineers will help you arrive at reasonably close figures for any individual application.

Figures Show What You Can Save With L-M's VDS Method

Conventional Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 OCB's, 1000 MVA interrupting capacity; cost, about $13,500 each	27,000
Total, about	$47,000
Voltage Divider Switching Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 switched steps using 30 Kyle NR switches (15 in each step) and equipped with all necessary isolating transformers and insulators; cost, about	8,400
Total, about	$28,400
Saving, VDS Method over conventional, about	$18,600


TIMES NORMAL VOLTAGE ACROSS ONE OPEN SERIES GROUP
N= ∞ 17 9 5 3 2
N=NUMBER OF SERIES GROUPS
SHORT TIME OVERVOLTAGE AS A FUNCTION OF STEP SIZE RATIO
KVAR RATIO OF ADDED STEP TO SUM OF ALREADY ENERGIZED STEPS

Overvoltages occur on the various series groups during switching. The highest overvoltage occurs when all but one switch of the second step are closed. These overvoltages are of brief duration and are kept at a safe magnitude by proper bank design.

Get Complete Information—Details of the new L-M Voltage Divider Switching Method (patent applied for) are available in a technical paper. Ask the L-M Field Engineer for a copy, and for information about L-M's Capacitor Application Engineering Service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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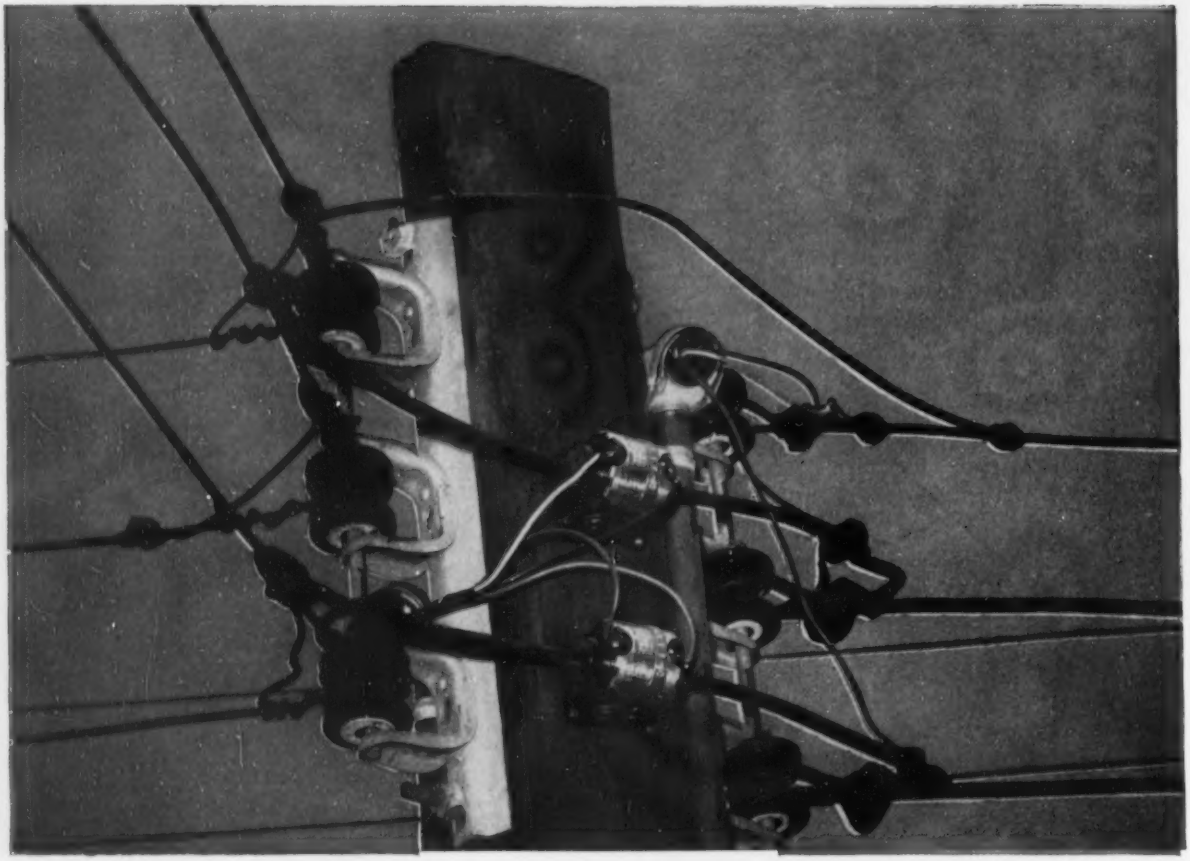
LINE MATERIAL *Elemex Capacitors*



CUT INSTALLATION COSTS

with the *new* SANGAMO Type R Current Transformers

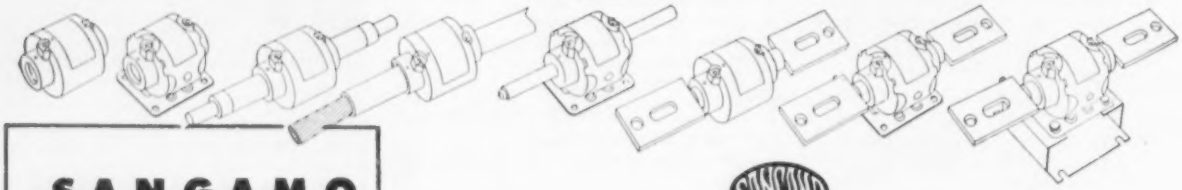
Eight variations of ONE basic transformer permit almost *any* primary arrangement.

New time and money saving installation methods are now made possible by the small size and light weight of Sangamo Type R Current Transformers.

In the installation shown above, made by a southern utility company, the base of the transformer is mounted to the pole. However, this rugged transformer is light enough so that it can also be mounted without the base by merely supporting it by the cable. Another saving is enabled by wiring secondary leads in the shop, with subsequent reduction in field installation time.

Type R Transformers are encased in a high impact phenolic shell filled with a thermo-setting plastic that eliminates voids and prevents moisture from reaching the core windings. The large opening in the Type RC-6 Transformer will admit a 250 MCM weatherproof cable in the 200 ampere rating, and 500 MCM weatherproof in the 400 ampere.

Full information is given in Bulletin 501. Be sure to get your copy.



SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-5

NEWS ABOUT PEOPLE

DONALD C. LUCE

LYLE McDONALD

Luce Heads Public Service E&G

New Jersey utility's new president succeeds George H. Blake, who retired. Lyle McDonald is new board chairman

Donald C. Luce, vice president in charge of combined operations of Public Service Electric & Gas Co, Newark, N. J., has been elected president to succeed George H. Blake, who has retired. Lyle McDonald, a vice president, has been elected chairman of the board of the utility.

Blake, who has been president since 1945, will continue to be a director.

Began as Cadet Engineer . . . A graduate of Lehigh University, Luce started with Public Service in 1924 as a cadet engineer in the electric department. He has been vice president in charge of combined operations, a director and member of the executive committee of the board of directors since March, 1950. Previously he was vice president in charge of electric operation and prior to that was general manager of the electric department for six years.

The new board chairman has been a vice president since 1944 and a director and member of the executive committee of the board since 1945. He started with Public Service in 1916 as an accountant. He was made comptroller in 1937, vice president and comptroller in 1944, and vice president in charge of finance in 1948.

Served in Legal Posts . . . Blake has been with the utility since 1910, having started as a trial attorney. He was appointed general solicitor in 1923, a director in 1934, vice president in 1937, executive vice president in 1943, and president two years later.

•

Laurence W. Scott has been made consumer products advertising manager for Westinghouse Electric Corp to succeed **Robert M. Fichter,** recently named sales manager of refrigeration specialties for the Electric Appliance Division at East Springfield, Mass. A former Montgomery-Ward sales executive, Scott joined Westinghouse in August, 1953, and was assigned to the consumer products sales staff.

W. W. Snow, formerly power sales engineer in the industrial development department of Florida Power Corp, has been promoted to executive assistant to the utility's vice president in charge of division operations.

Dr Edward A. Kern has been named manager-engineering for General Electric Co's silicone products department. Associated with laboratory research activities at GE's Transformer Division in Pittsfield, Mass., since 1942, Dr. Kern leaves his present post as manager of the materials and processes laboratory to make his headquarters at the silicone products plant at Waterford, N. Y.

Sales Staff Created by MECO, PENELEC

Creation of a news sales staff to serve both Metropolitan Edison Co and Pennsylvania Electric Co has been announced by T. O. McQuiston, MECO vice president and PENELEC sales manager. Headquarters for the staff will be established in MECO's new building at Reading, Pa.

Staff members include: Gerald T. Clifford, assistant to the vice president and advertising manager; Daniel K. Park, publicity manager; Robert W. Smith, residential and farm sales manager; John L. Beaver, commercial sales manager; and Lawrence E. Weber, municipal sales manager.

Residential Sales Experience . . . Clifford, who has been advertising and publicity manager for PENELEC, started his utility career in 1928 when he joined Bradford Electric Co. He was named residential sales director for PENELEC's Northern Division in 1943 and director of advertising in 1945.

Formerly a staff member of the Reading (Pa.) Times, Park started working for MECO as editor of its employee publication in 1947 and during the past three years served as its advertising manager.

Smith, new residential and farm sales manager, has held a similar post for MECO since 1952. He began his employment with that utility in 1934 as a cadet engineer.

Beaver joined MECO as a commercial cooking specialist, subsequently serving as commercial manager and commercial sales director. Weber was with General Electric Co before going to MECO in 1928 as a salesman in its Lebanon office. He went on to serve as industrial sales representative, director of street lighting, and municipal sales director.

In his new capacity, Clifford appointed Benjamin D. Barr, promotion director for MECO, to the post of promotion director for the combined companies. Barr has spent the past 31 years with MECO filling advertising, promotional and various other related posts.

Smith announced the appointment of Mrs. Elizabeth McD. Thomas as home service director and the appointment of Roy R. Smith as farm sales director.

G. E. DUERR

West Penn Names Duerr General Sales Manager

West Penn Power Co has promoted three employees to new sales positions.

G. E. Duerr was advanced from industrial sales manager to general sales manager and F. F. Dickmann was elevated from senior industrial engineer to manager of industrial sales. J. N. Engel, assistant to the vice president of sales, was appointed manager of market research.

Duerr, a 30-year veteran of West Penn Power, is a graduate of the University of Pittsburgh. He began with the utility in 1924 as a field engineer. He became assistant to the industrial sales manager in 1930 and industrial power engineer in 1938. Ten years later he was named industrial sales manager.

Dickmann, a Penn State College graduate, joined West Penn in 1933, advancing to senior industrial engineer in 1948. With the Pittsburgh utility since 1931, Engel has been serving in the executive aide's post since January, 1952.

•

William A. Uline, formerly general sales manager of the Scintilla Division of Bendix Aviation Corp, has been named sales manager of Continental Radiant Glass Heating Corp, New York.

Frederic Attwood, vice president in charge of Eastern territory for Ohio Brass Co, will retire May 1. He will, however, continue to serve as vice president and director, although withdrawing from active duties. He joined the company in 1920 as general European agent, becoming a vice president in 1927. Attwood is president of the U. S. National Committee of the International Conference on Large High Tension Electrical Systems (CIGRE) and a member of the U. S. National Committees of the International Electrotechnical Commission (IEC) and the World Power Conference.

A. M. Riddle, manager of Colorado Fuel & Iron Corp's market research department since 1942, has been appointed executive assistant to the company's Pres A. F. Franz.

S. K. Hostetter, Jr., sales manager of Elliott Co's Crocker-Wheeler Division for the past year, has been made general manager of the division. Hostetter, who joined Elliott in 1934, was district manager for ten years in the company's Washington office before going to the Crocker-Wheeler Division.

G. E. Olerud has resigned as manager of Cass County Electric Cooperative, Inc, Kindred, N. D. He has held the post for the past 17 years.

R. C. Ulmer has been made head of the research department of Combustion Engineering, Inc, New York, to succeed the retiring **B. J. Cross,** who has been appointed research consultant. Dr Ulmer, who has had considerable utility experience, last year joined Combustion Engineering, where he has been concerned with chemical problems in the Nuclear Energy Division. Cross became associated with Combustion Engineering in 1920.

Appointed Research VP

Dr James B. Fisk, director of research in physical sciences at Bell Telephone Laboratories, New York, has been elected vice president in charge of research. Dr Fisk, who joined Bell Laboratories in 1939, succeeds Dr Ralph Bown, who continues as a vice president with a new assignment in charge of the long-range planning of the Laboratories' programs. Dr Fisk, who served two years as director of research of the Atomic Energy Commission, is currently a member of the general advisory committee of AEC as well as the science advisory committee of the Office of Defense Mobilization.

Purchasing Unit Set Up by Indiana & Michigan

Indiana & Michigan Electric Co has announced the establishment of a new central purchasing and stores department at Fort Wayne, Ind.

L. Kenneth Kimmel, I&M's supervisor of stores and transportation, is head of the new department. Oswald Olson, supervisor of purchasing and stores at South Bend, was named assistant supervisor of stores and transportation.

In other appointments, Carroll R. Lang, supervisor of purchasing and stores for the Marion-Muncie Division at Marion, was made purchasing supervisor. E. J. Masbaum, assistant purchasing supervisor of the Fort Wayne Division, was appointed purchasing assistant; and Clarence A. Gebhard, chief clerk of stores records at Fort Wayne, becomes materials supervisor.

OBITUARY

William B. Farnsworth, 53, assistant to the president of Georgia Power Co, died at Atlanta March 23. A native of Memphis, Tenn., Farnsworth joined Georgia Power shortly after graduating from the Georgia Institute of Technology in 1925. He served as merchandise manager for ten years prior to becoming assistant to the president in 1950.

Daniel Boone, 48, newly appointed assistant general manager in charge of financing, business development, and sales of the Salt River Project Agricultural Improvement & Power District, Phoenix, Ariz., died there March 15. Boone, who started with the Salt River Valley Water Users' Association in 1928, formerly served as treasurer of the Salt River Project, which is comprised of the Power District and Water association.

Bert A. Miller, 82, retired power plant engineer of Willard (Ohio) Water & Electric Department, died March 9 at Willard, Ohio. He was chief engineer when he retired in 1945.

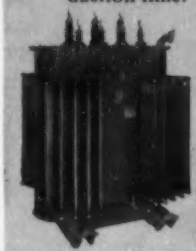
Floyd H. Mason, 69, former assistant advertising manager of Rochester Gas & Electric Corp, died March 2 at Rochester, N. Y. He was editor of the Rochester G&E News until his retirement.

Today's best buy!

PENNSYLVANIA Standard Parts POWER TRANSFORMERS

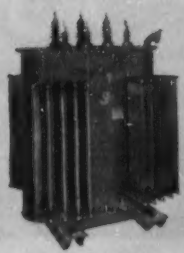
Faster deliveries are assured

when you order Pennsylvania Standard Parts Power Transformers. That's because quantity production methods of manufacturing, coupled with the use of standard designs and standard parts, shorten engineering and production time.



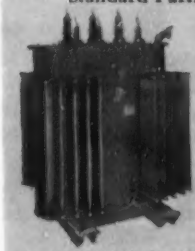
A wide range of optional voltages

is permitted with Pennsylvania Standard Parts Power Transformers, including 2 taps above and 2 taps below the primary voltage.



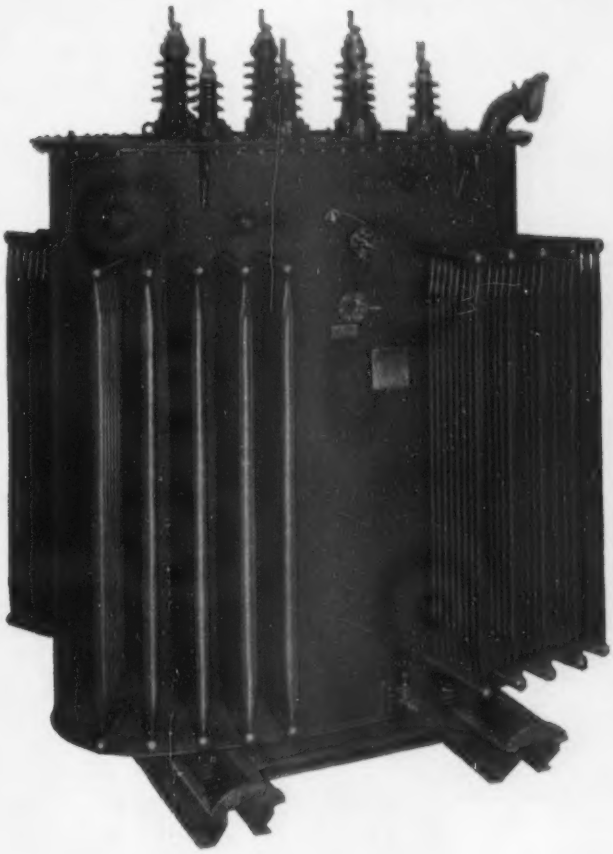
You have a choice of the method of oil preservation

in the larger ratings of Pennsylvania Standard Parts Power Transformers.



Optional equipment such as

current transformers, high voltage switches, etc., are available with Pennsylvania Standard Parts Power Transformers at regular prices, without any penalty being added to the base price of the transformer.



If your requirements call for power transformers in sizes up to 5,000 Kva, single phase, and 10,000 Kva, three phase — 69 Kv or less — then by all means find out about Pennsylvania Standard Parts Power Transformers. You will save up to 8% in capital investment, and get quicker deliveries. An example of this is the 2500 Kva, three phase Pennsylvania Standard Parts Power Transformer pictured above. This transformer cost the purchaser $1026.00 less because he specified Standard Parts.

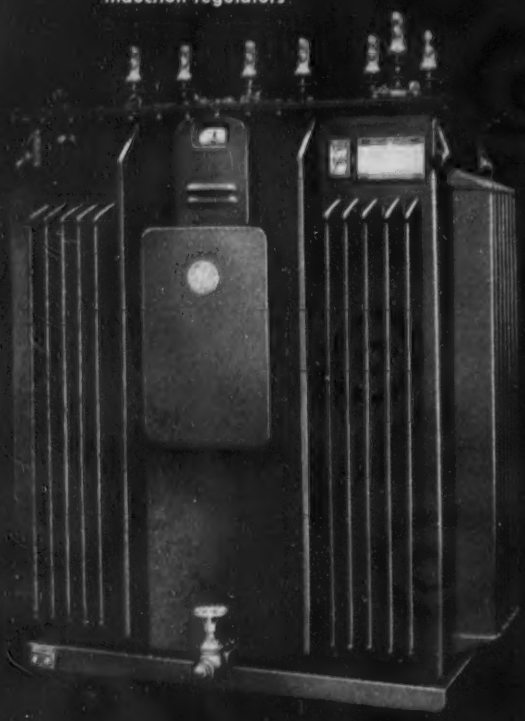
Pennsylvania Transformer Company

A McGRAW ELECTRIC COMPANY DIVISION

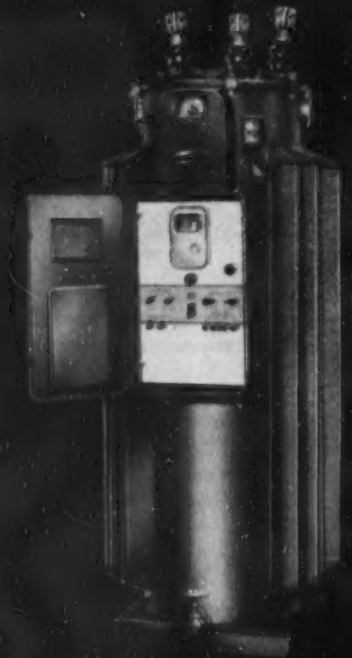
CANONSBURG, PA., Greater Pittsburgh District

FEEDER VOLTAGE REGULATORS

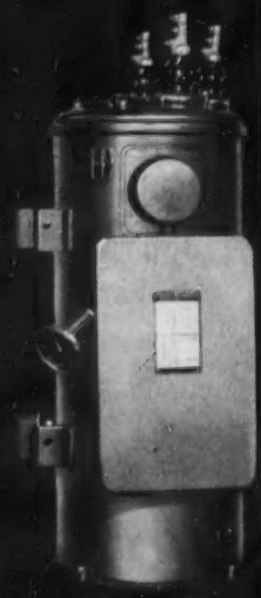
a complete line of both step and induction



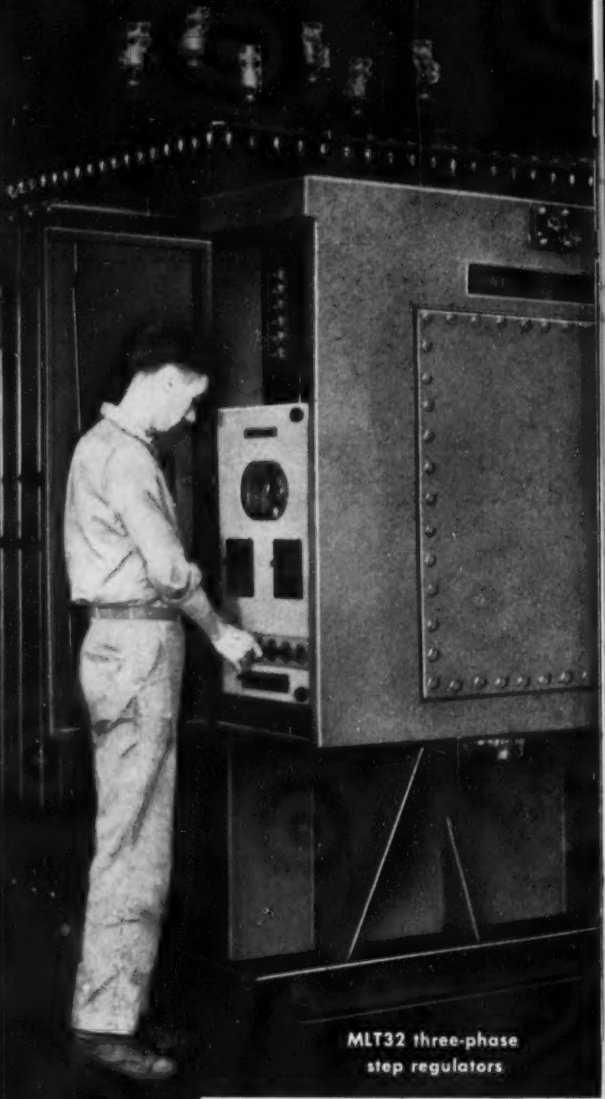
IRT three-phase
induction regulators



IRS single-phase
induction regulators



ML32 single-phase
step regulators



MLT32 three-phase
step regulators

ADVANTAGE OF CLASS 1 ACCURACY is illustrated in diagrams at right which show how a reduction in *effective* bandwidth permits a greater voltage drop in primary, transformer, and secondary while maintaining the same voltage standards from first to last consumer.

regulators with the economy of

Class 1 Accuracy at no extra cost

Whatever your voltage problem, you'll find a dependable, low-cost solution in this complete line of General Electric feeder voltage regulators.

G-E Induction Regulators, available for circuits up to 15 kv and 3000 kva, provide smooth, stepless control and need virtually no maintenance. For close regulation of single-phase feeders where operations are frequent and immediate voltage correction is required, G-E Type IRS single-phase induction voltage regulators offer the finest regulation obtainable. Their rugged operating mechanism and the elimination of switching contacts give you a maintenance record unbeaten anywhere. Type IRT three-phase induction regulators offer the same advantages of rugged construction, long life, and negligible maintenance.

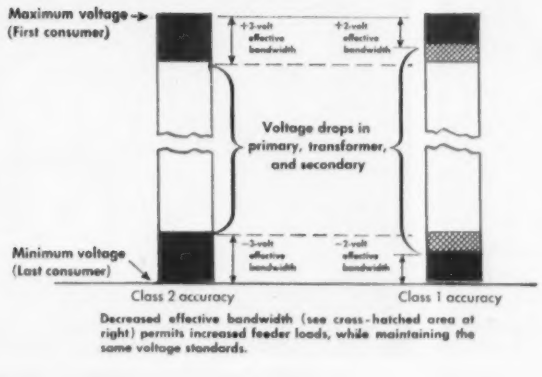
G-E Step Regulators assure dependable and economical regulation where you handle large blocks of power, and where you need supplementary regulation on your branch and rural feeders. For three-phase circuits, station-type MLT32 regulators adjust voltage in thirty-two 5/8% steps (Best suited for lines with balanced loads). They feature accessibility and ease of maintenance of switching mechanism. G-E Type ML32 single-phase step regulators also adjust voltage in thirty-two 5/8% steps, and give low-cost, dependable regulation on branch and rural circuits.

Class 1 Accuracy, the highest accuracy classification defined by ASA Standards, is a standard feature on *all* G-E voltage regulators. When compared with regulators with Class 2 or Class 5 accuracy, the G-E regulator with Class 1 accuracy permits (1) greater feeder length at the same load density, (2) greater load on existing feeders, or (3) higher voltage standards on existing feeders. Insist on Class 1 Accuracy controls. They mean *dollars* in your pocket with not one additional *cent* in investment.

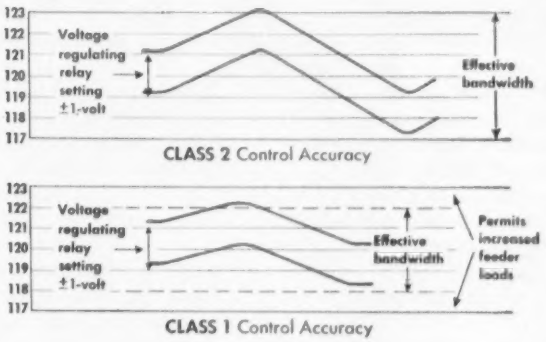
For More Information about G-E voltage regulators, contact your nearest G-E Apparatus Sales Office or authorized agent. Or write Section 423–4, General Electric Company, Schenectady 5, New York.

Progress is our most important product

GENERAL ELECTRIC



Decreased effective bandwidth (see cross-hatched area at right) permits increased feeder loads, while maintaining the same voltage standards.



Flatiron Pump-Turbine Gives 'Big T'

Bureau of Reclamation's newest hydro unit is a pretty versatile, reversible machine. It's a pump turbine that has just gone on the line at the Flatiron Plant in the Colorado-Big Thompson project near Denver. Throw the switch one way and you can use it to pump water up 200 feet into a storage and irrigation reservoir; throw it the other way and the water drops down the tube to produce some profitable peaking power.

The whole works is geared to the primary purpose of the project, which is to supply water for lands of the Colorado Conservancy District. It helps materially in repaying the cost of the project, according to William A. Dexheimer, Commissioner of Reclamation.

Flatiron, with its 3-unit total capacity of 71,500 kw, brings Big Thompson Project capacity up to 179,500 kw. "Big T", which has been 15 years in building, diverts water from Colorado's Western Slope through the 13-mile Alva B. Adams tunnel under the Continental Divide 8,000 ft above sea level to supply water for irrigation and power on the Eastern Slope. Flatiron is the last of five hydro plants to be built on the project's eastern slope.

Two Cool, One Crazy . . . Flatiron has two conventional water turbines, producing 31,500 kw each. The third, the combination pump-turbine, is anything but conventional. It's one of the few major installations of its kind in the country.

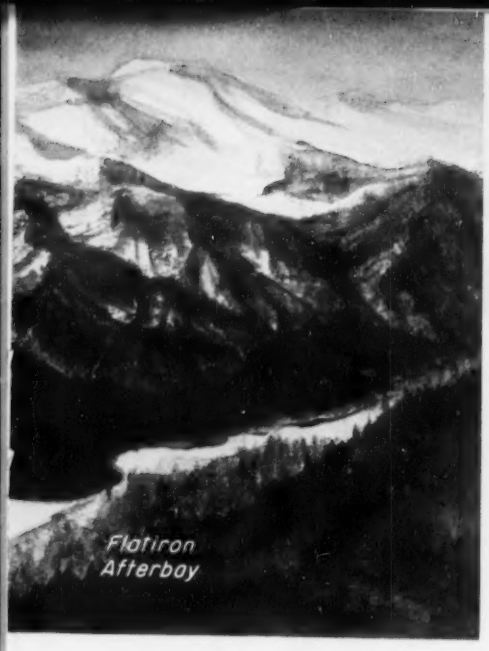
(TVA recently put one in—a 58,000-kw turbogenerator at its Hiwassee Dam in North Carolina. EW, May 11, 1953, p 36.)

When it is used as a pump, the Flatiron unit lifts water vertically from the station's afterbay through more than a mile of pressure tunnel and 1,700 ft of pressure conduit into the 112,000 acre-ft Carter Lake Reservoir. The lake is one of two major storage facilities of the project's Foothills System—the other is Horsetooth Reservoir, to the north.

Water is pumped into the reservoir during periods when demand for energy is light—making use of low-cost, off-peak power. From the lake, the water may be released southward via the St. Vrain Supply Canal to irrigated lands of Northern Colorado Water Conservancy District, or it may be returned through the conduits for transfer to Horsetooth and ultimate delivery to other Conservancy District lands. When this happens, the pump unit becomes a generating unit, with tunnel and conduit serving as penstock for the turbine.

The pump is used as a generator

FLATIRON PLANT, where 8,500-kw pump-



only at peak periods. At this time, market value of power generated is much higher than the value of off-peak power from the units used to operate the generating unit as a pump motor. Installation of one reversible unit to do two jobs produced major savings in the cost of equipment, installation and maintenance, Commissioner Dexheimer said.

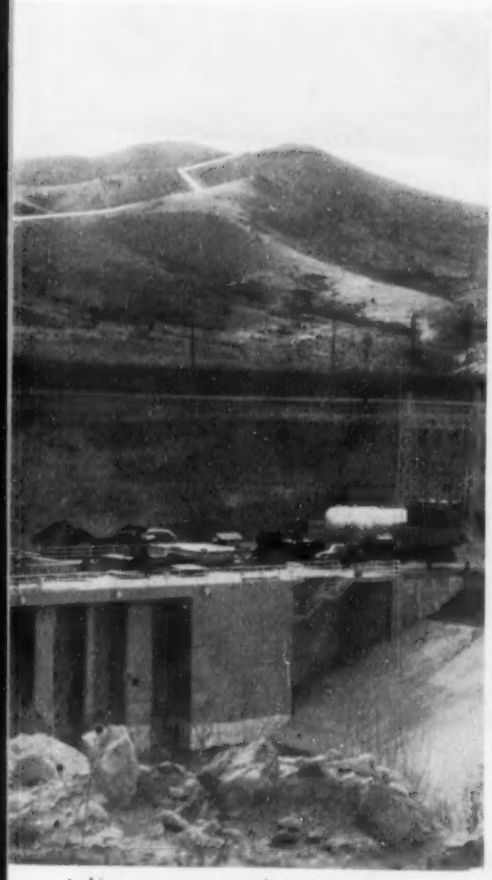
13,000 hp/8,500 kw . . . As a pump, the unit has a rated capacity of 370 cfs at a lift of 240 ft. The pump motor is a 13,000-hp unit. When reversed as a turbine-generator, it has a rating of 8,500 kw.

The other two units of the plant use a head of about 1,100 ft. Water that drives them is diverted from the stage above through more than a mile of pressure tunnel and then down the mountain through two 6,000-ft steel penstocks seven ft in diameter.

Inclusion of hydro plants on the east-slope part of the project made for maximum use of water dropping almost 3,000 ft in stairstep stages on its way from the Adams tunnel to storage facilities next to irrigated lands. On its way down, the water generates power in five successive plants: Marys Lake, Estes, Pole Hill and Big Thompson.

With Flatiron now on the line, the total project comes very close to being complete. Only major jobs to be done are three main canals to be excavated along the eastern side of the supply works.

Water a Lift in the Colorado Rockies



turbine generator recently went on the line

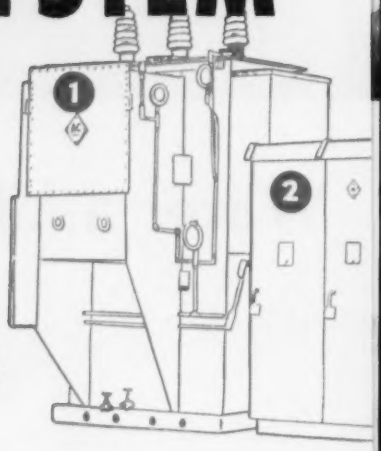
PENSTOCKS to Flatiron slither down east slope of Rockies

ALLIS-CHALMERS

MULTI-CIRCUIT

Unit Substations

GROW WITH YOUR DISTRIBUTION SYSTEM



1. By Double Ending
2. Adding Feeders
3. Increasing Transformer Size

Here's How Allis-Chalmers Substation Design Eases Future System Growth Problems

YOU CAN PREDICT your entire system load at some future date easier than you can predict that of a specific substation. A new housing development, a new industry, a new shopping center—each can make a major change in the load on one substation without greatly affecting the entire system. That's why substation design must be *flexible!*

Easy Field Assembly Speeds Expansion

Allis-Chalmers unit substations not only meet your immediate needs, but are designed to grow with the areas into which they are installed. They are designed for easy addition of feeders . . . easy double ending . . . and easy application of larger capacity transformers.

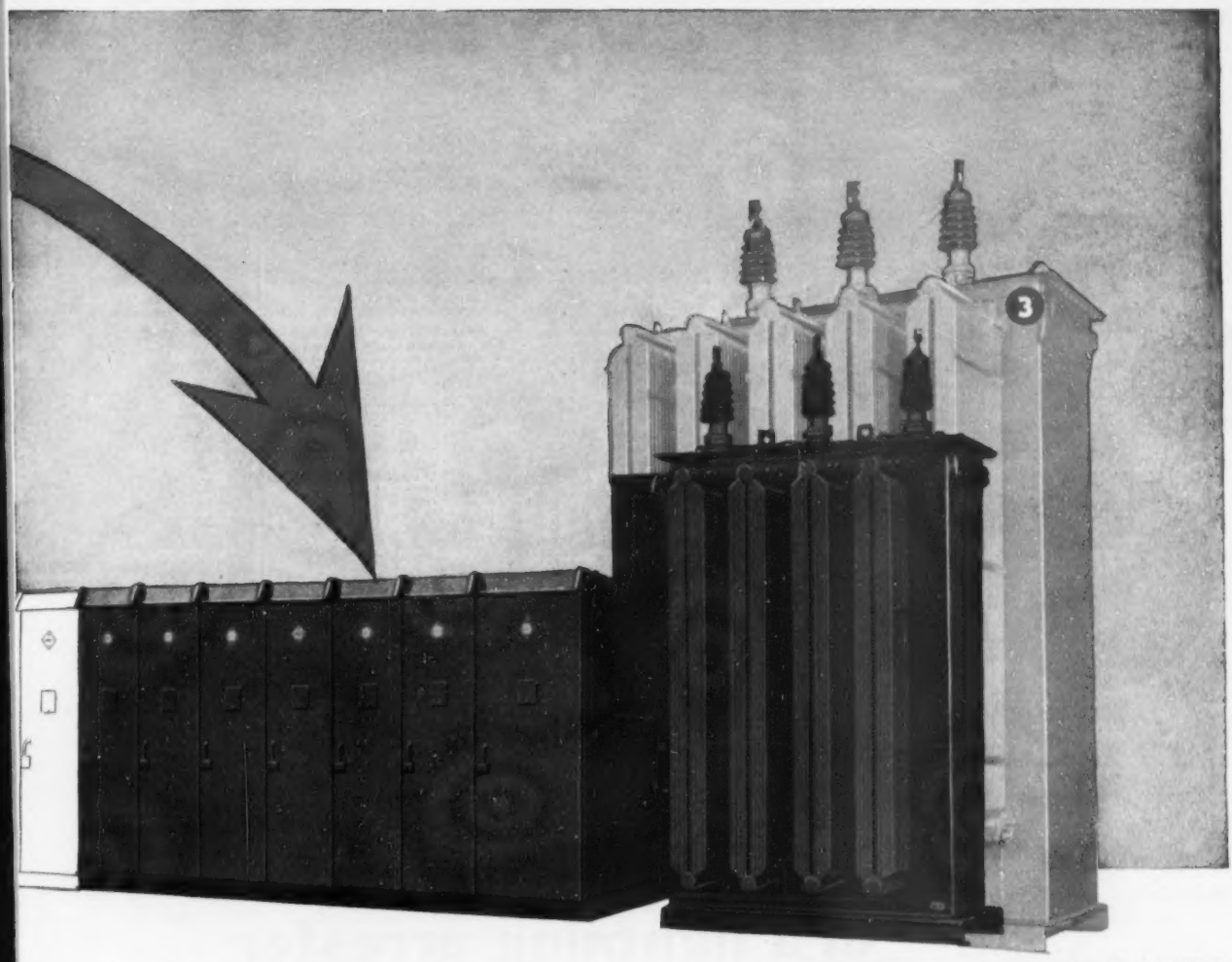
Allis-Chalmers Unit Substations are a convenient answer to the growing distribution problem . . . to the ever increasing demand for power and yet more power. They are simple to specify, neat and modern in appearance, and easy to expand.

You Save These Five Ways

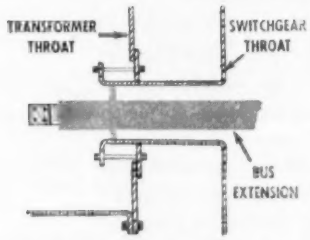
(1) Original equipment cost is low; (2) compact construction reduces space requirements and real estate costs; (3) pre-wired unit design speeds installation; (4) maintenance is quick and economical because of improved accessibility; and (5) you purchase only the equipment you need *now*, deferring additional expenses until load growth demands the expenditure.

For the full story on what Allis-Chalmers Unit Substations can mean in your distribution system, call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3585

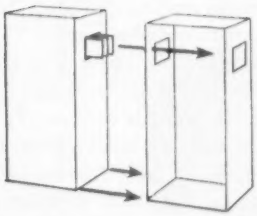
ALLIS-



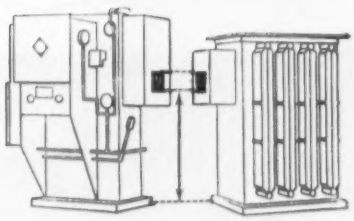
MCS Substations are Expandable These 3 Ways



1 **DOUBLE ENDING** is easy. Throat openings of transformer and switchgear are at exactly the same height. Bus connectors and transformer throat are flexible enough to permit realistic tolerances in concrete base construction. Silver-plated, pre-drilled bus extensions bolt together, are tape covered to speed field assembly.



2 **FEEDER UNITS** are easy to add because they are jig built. Each feeder cubicle is exactly like every other one. Bus extension openings, control wiring openings — even small screw holes — are precut in jigs for perfect alignment. This uniform construction, plus two sides on every cubicle, makes field assembly easy.



3 **A HIGHER CAPACITY TRANSFORMER** — within the limits of breaker size and bus capacity — can easily replace the installed transformer. Standardized throat height on all A-C substation transformers, regardless of rating, permits one transformer to replace another without cutting or reforming the throat or bus.

CHALMERS

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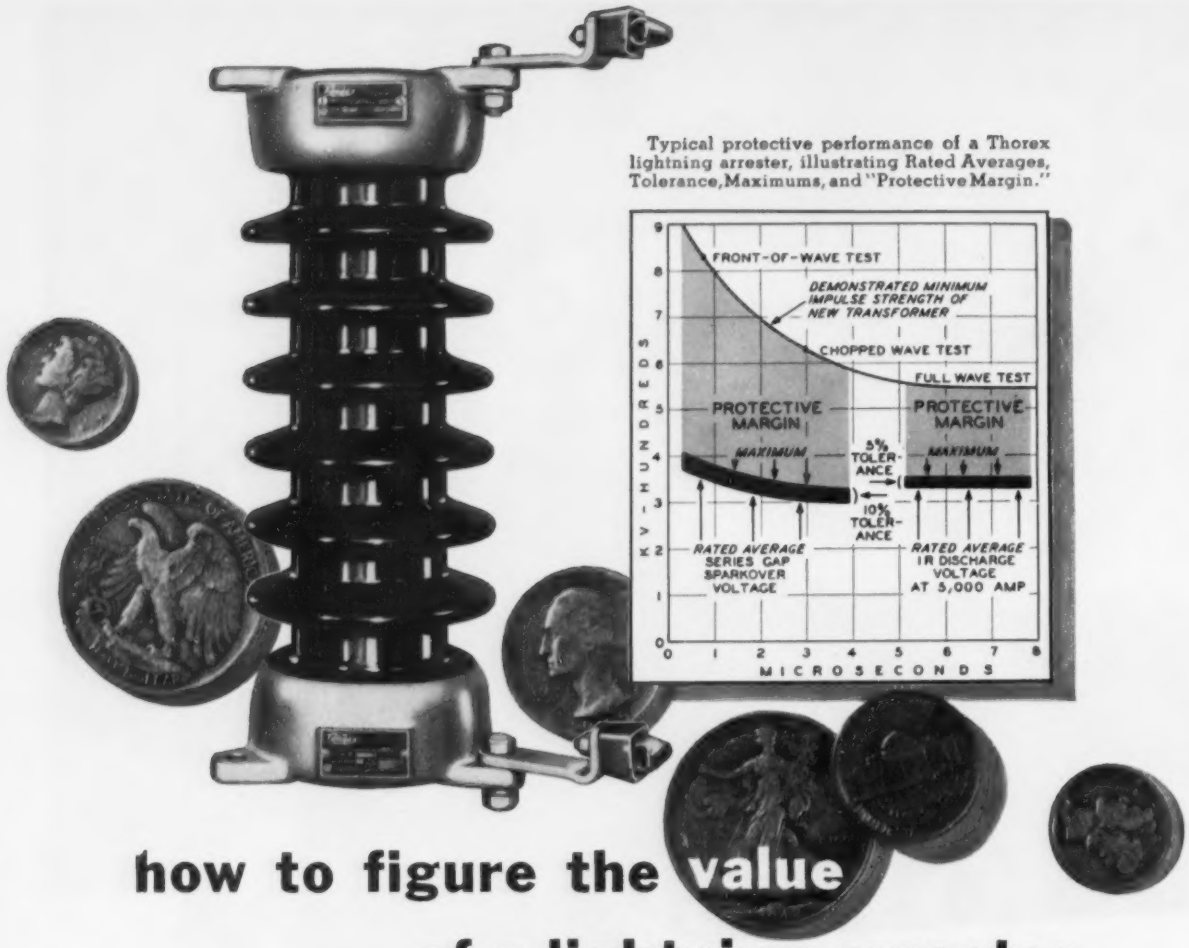

Typical protective performance of a Thorex lightning arrester, illustrating Rated Averages, Tolerance, Maximums, and "Protective Margin."

how to figure the value of a lightning arrester

Is there any positive way to measure your money's worth in the purchase of a lightning arrester? Actually, you can arrive at such a figure, accurate to the second decimal place!

Take rated average catalog IR discharge values. To these add the manufacturer's tolerance. The sum of the two is MAXIMUM protective level -- the only realistic point from which arrester performance can be measured. *Every* Thorex arrester meets or improves on this value. You already know the minimum impulse insulation strength of your equipment. Between the two is a zone called "Protective Margin". It is expressed in kv. Cost of your arrester is expressed in dollars. See what you *pay per kv* of Protective Margin and you will end up buying the O-B Thorex -- giving you not only the greatest protection per dollar, but the greatest protection regardless of cost!

Ohio Brass

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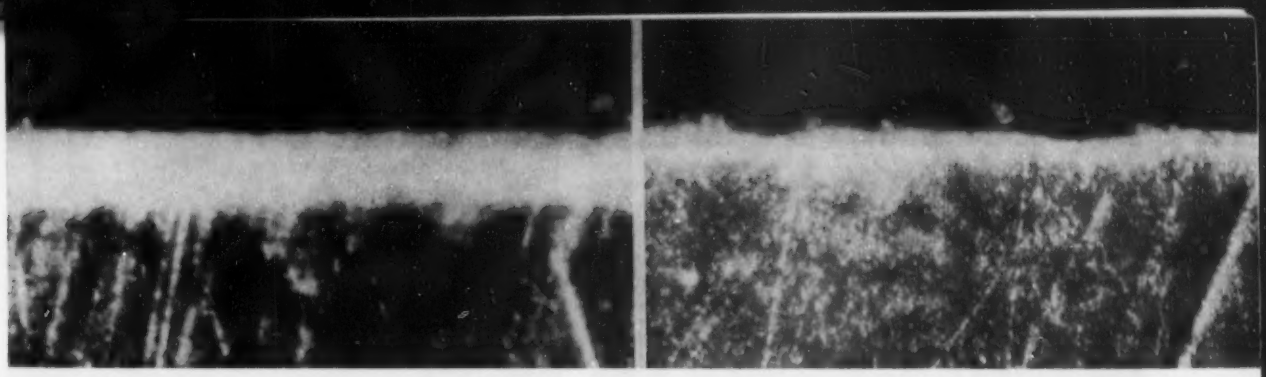


FIG 1—MICROPHOTOS show a heavy coating compared with a commercial coating. Coating at the left meets the .0005-in. minimum requirement while that on the right is .00018 in. minimum. Specification for coating thickness was result of research study

Four-Year Research Favors . . .

Cadmium for Plating Connectors

D. C. HUBBARD, Chief Development Engineer, **R. W. KUNKLE,** Manager, Engineering Divisions, **A. B. CHANCE,** Chemical Engineer, A. B. Chance Co, Centralia, Mo.

Fortified cadmium and hot-flowed electro-tin plate are the desirable materials for plating connectors used in aluminum to copper connections. This finding of A. B. Chance Co research engineers is backed by four years' study of designs for an electrical connector suitable for outdoor use on both aluminum and copper conductors.

These studies verified some earlier research findings by others, including suggestions for the use of a plated connector, corrosion inhibiting compounds, and clean conductors.

However, this reasearch indicated that failures have continued to occur primarily because earlier research reports were too generalized. Such reports did not give sufficient warning against the use of ultra-thin coatings. They were too broad in what they recommended with regard to the behavior of metals in contact with aluminum and copper in the presence of corrosive media normal to field service.

Problems Considered . . . Recommendations given here are based on studies of the design of an electrical connector, especially the bolted type, either parallel groove, cable clamp, bus fitting, or hot tap clamp, such as would be suitable for outdoor use on both aluminum and copper conductors.

The problem presented the following factors for evaluation: The difference in thermal characteristics between copper and aluminum, galvanic corrosive action possible when two dissimilar metals are in contact in the presence of an electrolyte, and the human equation in making up joints.

Performance Evaluation . . . In evaluating connector performance, research was directed to such basic factors as:

1. Intimate connector contact with at least every external strand of the conductor for maximum current distribution.

2. Adequate contact design for satisfactory joint resistance.

3. Adequate pressure for satisfactory interstrand resistance.

4. Mechanical allowance for expansion and contraction.

5. Adequate contact area to avoid overstressing the conductor through excessive clamping pressure.

6. Allowance for vibration effects as these produce bolt loosening and premature conductor fatigue.

Cadmium Characteristics . . . Cadmium, the study showed, is a good contact metal, comparable to nickel. Resistant to tarnish and corrosive influence, it is superior galvanically to many aluminum casting alloys as it does not seriously attack EC grade aluminum. It can be plated over aluminum without hazard of subsurface galvanic action

Footnote: This article is based on a paper by the authors before the Winter General Meeting of AIEE January 18-22, 1954

Tests considered:

- Corrosion due to salt fog, sea spray, hydrogen sulphide, organic compounds used as anti-corrosion aids, and weatherometer exposure.
- Effects of heat cycling by alternating overload and off currents.
- Combined corrosive attack, drying, and heat cycling.
- Conductor tension on joint performance.
- Auxiliary springs and loose joints.
- Clamping pressure.
- Corrosion and heat cycling on joints with and without anti-corrosion aids.
- Resistance measurements by bridge and millivolt drop methods, and their relation to joint condition.
- Extension of tests to breakdown of specimens.
- Each group of specimens (of like design and equal coating thickness) tested simultaneously to reduce variables, industry test standards being employed wherever practicable.

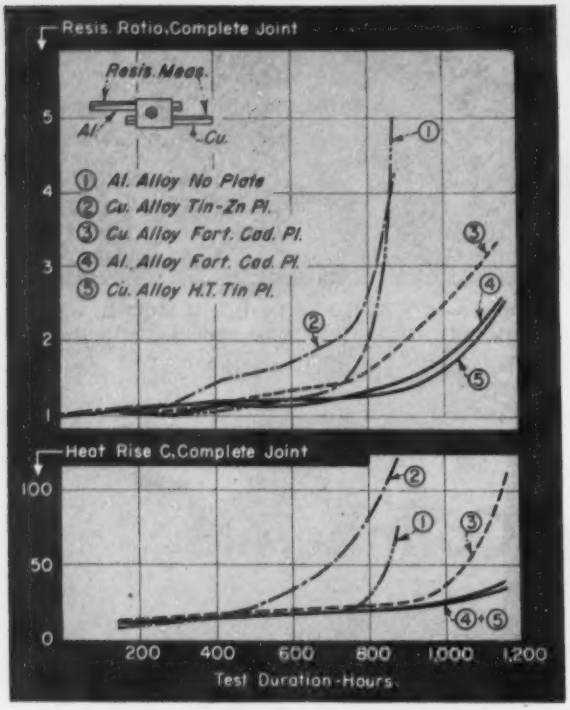


FIG 2—COMPARATIVE LIFE of connector plating resisting galvanic action in salt spray is shown. Connection is for aluminum to copper

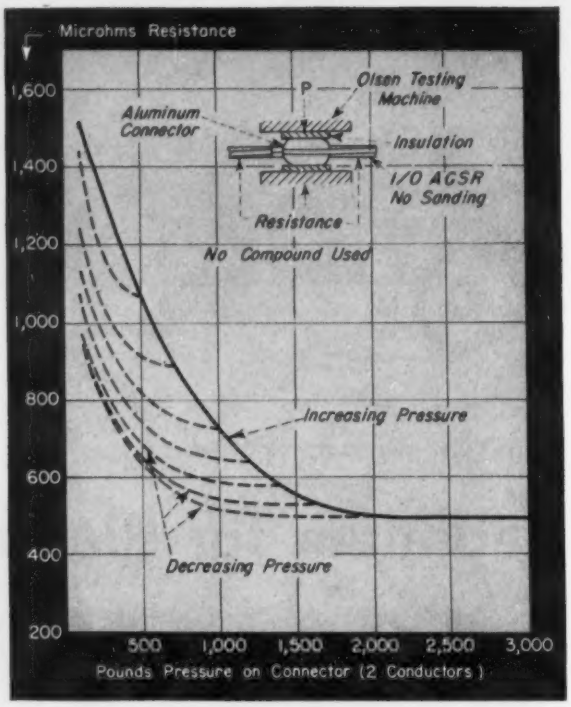


FIG. 3—EFFECT of presssure and relaxation on the resistance of a bolted joint. Tests supplied data on various kinds of contacts

and when so plated is the best metal now known to deposit on aluminum for weather resistance.

Fortified cadmium plate resists seacoast and alkaline attack and gives very satisfactory performance in industrial atmosphere. It gives superior performance on copper to aluminum joints even when anti-corrosion compounds are omitted.

Margin of Protection . . . In severely corrosive areas, heavy fortified cadmium plate on aluminum-bodied connectors offers a greater margin of protection to the aluminum conductor. Applied over aluminum alloys with proper base and surface treatments, it has these advantages over other combinations:

1. Damage to the coating exposing the base metal does not initiate subsurface corrosion between the coating and the base metal.

2. Similar damage to the coating is of no serious consequence in contact with aluminum conductors even though anti-corrosion compounds are omitted.

3. Damage to the coating does not cause joint failure on the copper conductor side of the aluminum to copper connection within any measured time. It did not cause joint failure during the test in which control specimens were exhibiting initial failure.

Coating Failure . . . Although evaluation of coating failure by visual inspection is difficult except for trained personnel, cadmium failure is disclosed by the appearance of copper as an exposed material.

Cadmium plate is improved by surface treatments, such as chromium chromate. Other treatments improve resistance to weathering attacks, industrial atmosphere, and heat dissipation, the last an important characteristic.

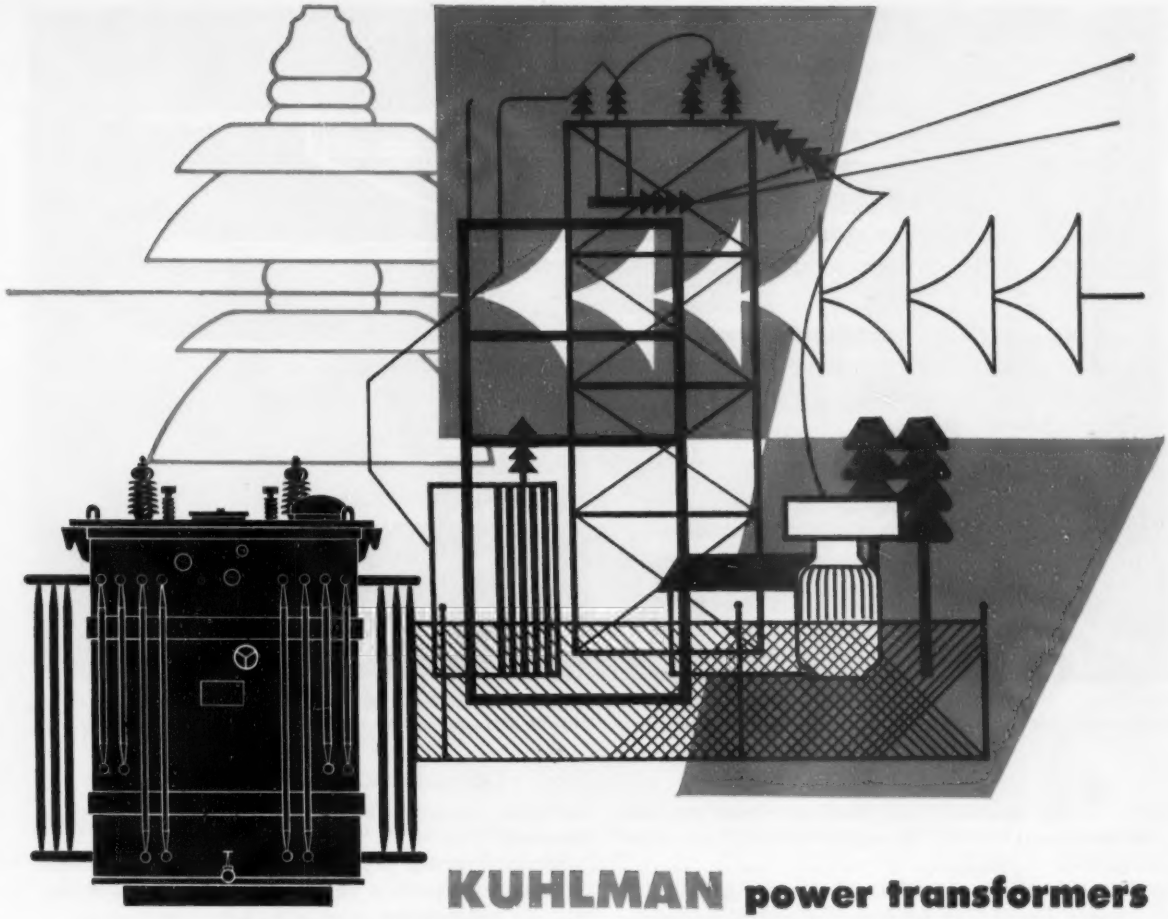
Fortified cadmium has demonstrated its prolonged joint efficiency, and its electrical performance remains good as long as galvanic attack is restrained. Heavy, that is, .0005 in. or thicker, fortified cadmium plate is equally satisfactory when either aluminum or copper connectors are applied as recommended by the manufacturer. It also was found to give superior performance over bimetal washers 0.30 in. thick.

Superior to Bimetal Washers . . . This superiority over bimetal washers is due to the fact that under corrosive attack galvanic action starts at the edge of the bimetal where the two metals are jointed. The galvanic action penetrates along the interface, ultimately separating the two materials and producing a high resistance contact. Cadmium plating was found better than copper liners soldered to aluminum bodies because some liners under corrosive attack become completely detached from the aluminum bodies in a relatively short time.

In the absence of corrosion inhibiting compounds, heavy fortified cadmium platings on both copper and aluminum alloy connectors joining copper to aluminum conductors outlast other plating combinations without joint loosening.

Copper has an affinity for very small amounts of cadmium which it absorbs in solid solution. The small area of exposed aluminum is slowly attacked by the copper conductor, resulting in some pit corrosion. But the mass of aluminum in a properly designed conductor can withstand such pitting. The copper conductor is not affected, and corrosion inhibiting compounds prolong the life of the joint.

Tin Performance . . . On copper conductors, hot-flowed, electro-deposited tin has demonstrated good performance,



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SIXTY YEARS OF PROGRESS IN THE ELECTRICAL INDUSTRY

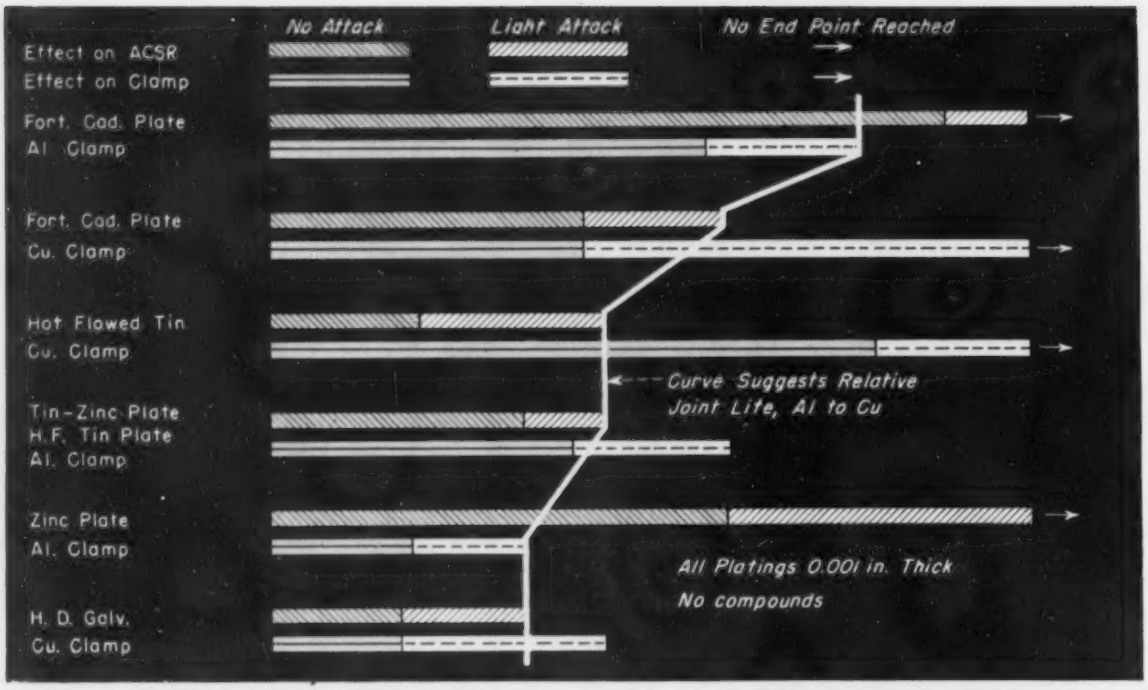

FIG 4—SALT SPRAY AND HEAT-CYCLING test on one-bolt, parallel groove clamp holding No. 2 ACSR to No. 4, 7-strand copper. Bolt torque is 150 in.-lb. Graph shows per cent resistance increase of original joint and heating caused by rated-conductor currents

and it is also satisfactory on aluminum where adequate joint compounds are used to exclude moisture and corrosive media.

Tin resists tarnish and rates with fortified cadmium in maintaining low contact resistance by preventing formation of high resistance film. But its use on aluminum-bodied clamps cannot now be recommended because of possible subsurface galvanic action. Hot-dipped tin is considerably more porous than hot-flowed, electro- deposited tin.

Heavy hot-flowed electro tin plate on copper alloy connectors with suitable corrosive resistant compounds appears to be satisfactory when the connectors are applied as recommended by manufacturer. It is superior to bimetal washers or copper liners soldered to aluminum bodies.

Tin failure on copper leaves a dull grey deposit not readily distinguishable from the original tin coating.

Plating Thickness . . . The Chance tests verified ASTM and military standards with regard to plating thickness. A depth of .0005 in. was found to be the minimum requirement for effective protection. Porosity and coating failure increase rapidly as coating thickness diminishes below this minimum. Increasing the thickness of some metals does not have a corresponding gain in performance.

Plating must be complete to be effective. A member when half plated is subject to corrosive action where the plating ends unless the plating is compatible with the base metal.

Contact Pressure . . . Contact pressure on plated connectors equal to that for unplated connectors produces superior joint conductance in the presence of joint contamination. Similarly, some plated conductors applied to new aluminum conductors have lower contact resistance than new aluminum connectors which were not scratch-brushed or chemically cleaned.

Scratch-brushing, preferably through a film of anti-corrosion compound, is an advisable preparation for joint make-up and provides an excellent low-resistant joint.

Excessive force deforms both the conductor and the connector without materially improving joint performance. Such force overstresses the materials at the joint and induces excessive creep in the conductor and clamp members.

Alloy Connectors . . . Both copper and aluminum alloy connector constructions are satisfactory when the design provides for adequate resilient take-up and contact area. Resilience is achieved by utilizing clamping members of proper section and using the elastic range of the bolt material.

Initial clamping force may cold flow the conductor or clamp, flattening line or point contacts into areas or deforming strands. But as long as the design of the connector members restricts these forces within the elastic range of the metals used, provision is made for continued creep of the material under stress. This property is used to provide for thermal expansion and contraction.

Belleville type washers are another means for sustaining adequate force to offset creep and thermal activity. These washers may be used to supplement connector resilience.

Bolts . . . Copper alloy bolts in general purpose connectors attack aluminum conductors where the space between the bolt and the conductors is bridged by foreign matter contaminated by an electrolyte.

Plated and galvanized steel bolts are superior to bronze bolts in this respect. Where steel bolts are replaced by bronze bolts of comparable strength in connectors, no improvement was noted under prolonged heat cycling.

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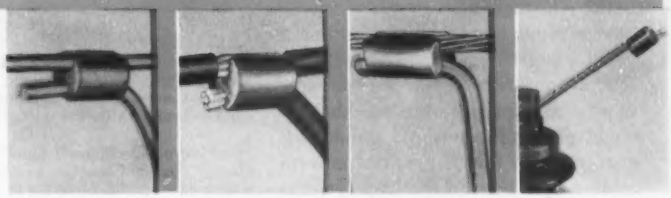
One crimp . . . and you've got the connection!

That's all it takes when you make a line joint with a Squeezon and a Squeezon compression tool. You get a *better* connection . . . a perfect bonded, permanent joint. That's because Squeezon connectors provide *separate*, full-circumference grip on each conductor, eliminate galvanic corrosion on transfer surfaces.

Squeezon economy and all-around utility will please you. Your line crews can handle any job in half the time and at a fraction of the cost of conventional methods. One Squeezon tool and two types of connectors . . . the aluminum and the solid copper . . . meet all line requirements.

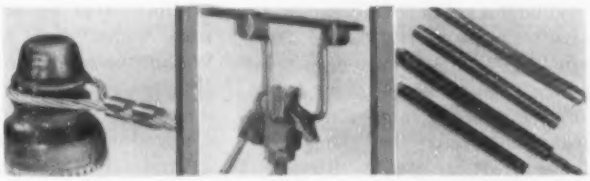


Copper Squeezon
One operation of the Squeezon compression tool permanently bonds this type of joint.

Aluminum Squeezon
Aluminum connector for aluminum conductor provides large area contact—prevents cold flow, for aluminum-to-copper or copper-to-aluminum. No special connector necessary.

For T Connections
Costly special connectors are eliminated by the use of Kearney Squeezon, for aluminum-to-copper connection.

Tap On
Squeezon's weld-grip high pressure bonding makes perfect aluminum-to-copper terminations.



Dead-Ends
One crimp per Squeezon saves time when multiple connectors are used.

Stirrup Tap
Two Squeezons and a short piece of wire make an inexpensive, easy-to-install stirrup, insures a rigid arc and corrosion-proof connection on hot lines.

Line Splice
Line splices are better electrically and mechanically with Squeezon sleeves.

The Squeezon Tool with controlled hydraulic pressure cold welds the connector to the conductor—tool hangs easily to conductor fully supporting its weight.

For Better Construction . . .
Safer Maintenance

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

252

Specify
KEARNEY Products

Partnership Body . . .

. . . to generate and market power in Pacific Northwest is proposed by 'Oregonian' editor

Formation of a federal non-profit corporation to generate and market power in the Pacific Northwest has been advanced as an "inevitable" step to implement the administration's "power partnership" concept. This view was advanced by Herbert Lundy, associate editor, the Portland "Oregonian," before the American Society of Military Engineers.

But across the nation in Washington, D. C., Democratic Congressmen from the Pacific Northwest have announced their intentions of thwarting proposed partnership legislation.

Joint Action . . . As outlined by Lundy, the regional corporation should have revenue bond financing authority as well as full power to join with the federal government in the building of new multipurpose projects that include power features. It should sell energy at the lowest possible uniform rates to public and private agencies on the basis of equality. Noting that the Pacific Northwest will need at least 10 million kw within the next 20 years, Lundy questioned whether the money could be expected to come from Congress alone.

Without a regional corporation, the partnership plan may lead to "fragmentation" and eventual dismemberment of the regional power system, Lundy remarked. In an editorial following the talk, the "Oregonian" doubted whether private dams and transmission lines could be built at costs low enough to compete with rates charged for power produced in Washington State by public power groups.

Partnership Bills . . . Meanwhile, action on partnership bills has been delayed. One of these concerns the formation of operating agency No. 1, the Washington State agency which proposes to build Priest Rapids on the Columbia River. Formal approval by the Washington State Power Commission is in doubt because there is the feeling the agency would have greater powers than the state commission. In the nation's capital, Oregon and Washington Congressmen have agreed on a modification of Priest Rapids project that would require distribution of power on a regional basis, rather than to customers in Washington only as originally planned.

Opposition to the partnership idea is expected from other Democratic Congressmen from the Northwest—Representatives Don Magnuson, Wash., Lee Metcalf, Mont., and Gracie Pfost, Idaho, and Sen Henry Jackson, Wash. They are against two bills which call for joint construction with the government of Rocky Reach project on the Columbia by Chelan County (Wash.) PUD, and Cougar Dam on Oregon's McKenzie River by the Eugene (Ore.) Water & Electric Board.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING JANUARY

State	Utility	Plant	Fuel	Capacity (Kw)
N. Y.	Niagara Mohawk Power	C. R. Huntley	S	80,000
N. Y.	Central Hudson Gas & Electric	Neversink	H	25,000
N. J.	Atlantic City Electric	Greenwich	S	10,000
Ohio	Columbus & Southern Ohio Electric	J. B. Poston	S	66,000
Ohio	Ohio Edison	Niles	S	106,000
Ill.	Breese Water & Light Department	Breese	IC	900
Ill.	Princeton Municipal Light Department	Princeton	IC	2,340
Wis.	Richland Center Municipal Utilities	Richland Center	S	4,000
Minn.	Adrian Municipal Light & Water Department	Adrian	IC	745
Iowa	Indianola Municipal Utilities	Indianola	IC	1,183
Iowa	Iowa Public Service	Hawkeye	S	11,500
S. C.	Corps of Engineers	Clark Hill	H	40,000
Fla.	Florida Power	Higgins	S	40,000
La.	Houma Municipal Light & Water Department	Houma	IC	2,555
Colo.	Bureau of Reclamation	Flatiron	H	31,500
Colo.	Bureau of Reclamation	Pole Hill	H	33,250

PLANT RETIREMENTS DURING JANUARY

Vt.	Central Vermont Public Service	Bethel	H	560
Mass.	Southern Berkshire Power & Electric	Great Barrington	H	200
Pa.	Pennsylvania Power & Light	Allentown	S	36,812
Iowa	Indianola Municipal Utilities	Indianola	IC	375
Iowa	Iowa Electric Light & Power	Oxford Mills	H	260
Mo.	Missouri Utilities	Poplar Bluff	S	2,300
Kan.	Western Light & Telephone	Great Bend	IC	775
Kan.	Western Light & Telephone	Plainville	IC	272
Miss.	Mississippi Power	Newton	IC	840
Tex.	Central Power & Light	Three Rivers	IC	959
Colo.	Gunnison Electric Department	Gunnison	S	1,475
Calif.	Southern California Edison	Long Beach	S	47,000

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of Feb. 1—Hydro, 22,174,954 kw; Internal Combustion 2,222,407 kw; Steam, 67,277,859 kw; Total, 91,675,220 kw.

Correction—The 100,000-kw unit at Houston Lighting & Power Co's Greens Bayou plant should not have been listed in the December table since the unit went into operation in the summer of 1953.

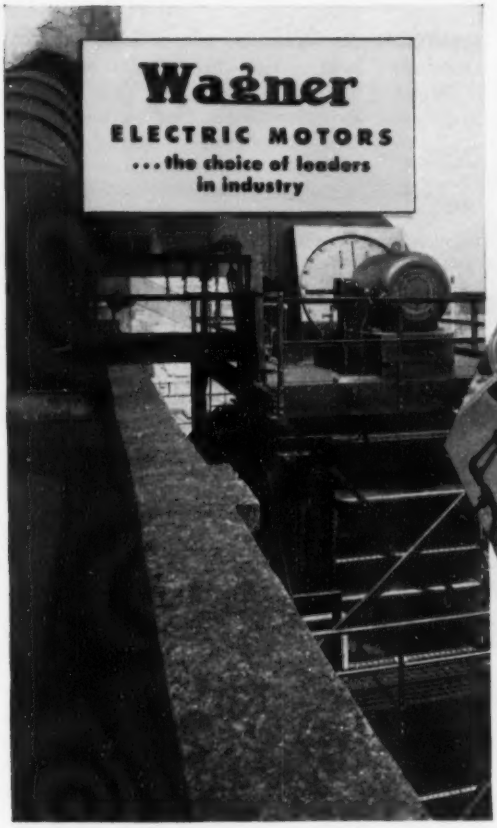
Not Backing McWhorter, Vardaman Declares

Claude O. Vardaman, chairman of the Republican State Executive Committee of Alabama, has denied that he is supporting Roger Barton McWhorter, Federal Power Commission chief engineer for the position of chairman of the Tennessee Valley Authority Board. He had served with Birmingham Electric Company before the two merged.

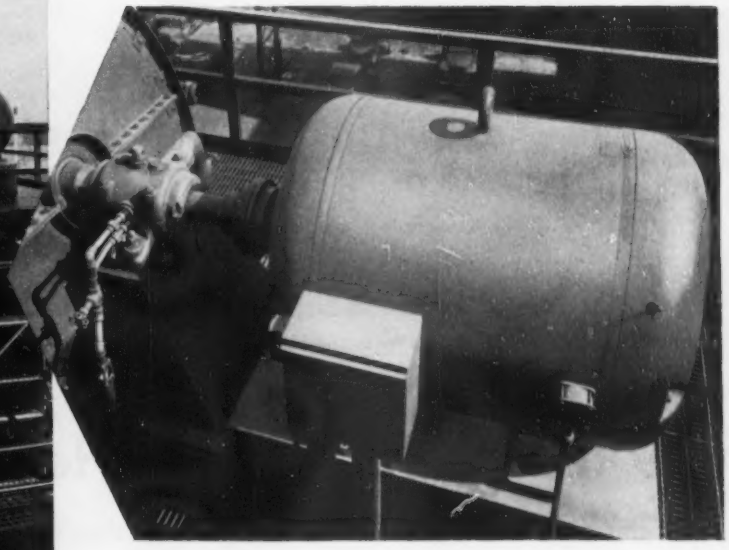
A news story appearing on page 15 of the March 15 issue of Electrical World listed Vardaman among those Alabama GOP leaders reportedly supporting McWhorter. The story incorrectly identified Vardaman as a vice president of Alabama Power Co. Actually he is employed in the company's industrial development department.

In a letter to Electrical World, Vardaman declared:

"I have given no endorsement, either written or implied to Mr McWhorter's candidacy for chairman of the TVA Board. I do not even know McWhorter and I have never talked with him, directly or indirectly, regarding this matter. In the circumstances of my employment I would hesitate to endorse anyone for the position you mention."



This fly-ash control equipment, on the roof at the Murray Corporation of America, is powered by a Wagner Increment Motor and Starter Combination.



to be a better neighbor

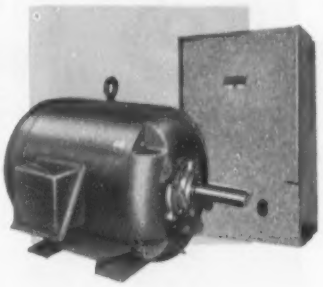
The nuisance of smoke and air pollution is a menace to good public relations for much of modern industry. Plant engineers are constantly seeking economical ways to alleviate this nuisance so that industry can be a better neighbor in its community.

A successful approach to the air pollution problem is this motor-driven fly ash collector on the roof at the Murray Corporation of America, Detroit auto body manufacturer. This effective installation is driven by a 250 hp, 220 volt, 1160 rpm totally-enclosed fan cooled Wagner Increment Motor and Starter Combination.

Why the increment motor and starter? Because this modern method of starting large squirrel-cage motors limits the inrush of motor current during the starting period to values that are acceptable to most power companies for all or parts of their distribution systems. These Wagner Combinations are economical, too. No auto transformers or resistors are necessary.

Wagner Motors are made in sizes from 1/125 to 400 hp, and offer a wide choice of enclosure types and mountings.

Your nearby Wagner engineer can help you select the right motors for *your* needs. Call the nearest of our 32 branch offices, or write us.



WAGNER ELECTRIC CORPORATION
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE
BRAKE SYSTEMS—
AIR AND HYDRAULIC

WM53-10

MODERATE SIZED HOMES make up the bulk of Indianapolis electric heating customers

MORE THAN 200 HOMES of this type are being built on one project and all will have electric heating

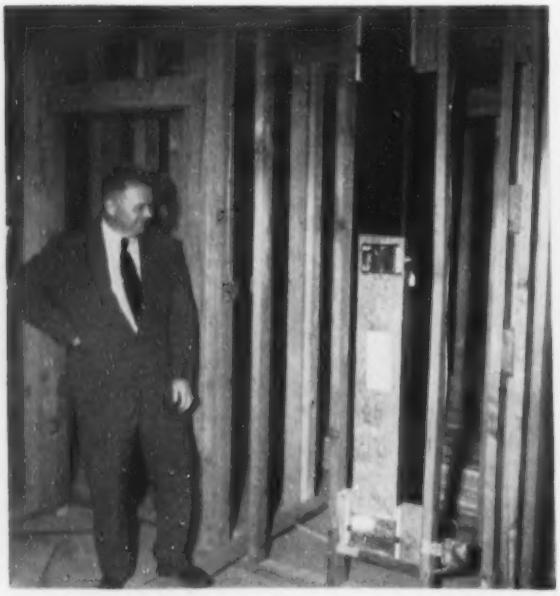
119 Indianapolis Homes Heated Electrically

200 unit project now under construction. Bills should average $256. Loads average 9.28 kw

During the 1952-53 heating season 58 homes on the Indianapolis Power & Light Company's system were heated electrically during all, or the greater part, of the season; and the total number of homes with primary electric heat was increased to 119 by the beginning of the present season.

The 58 homes used 598,200 kwhr for heating last season, which was warmer than usual with only 4,847 degree-days, or about 12% less than normal. Based on the consumption records of each home, and the actual number of degree-days in the period each home was heated electrically, it is estimated that a total of 741,000 kwhr would be used by these homes in an entire normal season, with an average heating cost of $256 per home. Connected heating loads average 9.28 kw.

For the most part homes that are installing electric heat are of the me-



HEATING ELEMENTS in the 200-home project are located in duct set in wall. Fan in duct circulates air over heating element with warm air coming out at lower grille and cold air going in at top.

RADIANT HEATING with wires fastened to the ceiling and plaster applied directly over them is being tried in several homes. Low initial cost plus overall room heating are advantages claimed

dium size and moderate income group. In some cases special conditions dictated the selection of electric heat, such as no one at home during the day except an aged mother who was not able to tend a furnace.

Discussions with users of electric heat revealed that they are generally enthusiastic. In the few instances where costs were thought to be too high a careful check revealed that the insulation on that particular job left something to be desired. When this was corrected all objections were eliminated. In several instances the users of electric heat commented on an apparent improvement in health of some member of the family and said it felt "just like sunshine."

Types of Installations . . . Practically all of the installations in this area to date have been of radiant glass panel type. One installation now being made will have resistance wires in the ceiling and plaster applied directly over the wires. The builder claims this is the cheapest available type of electric heating to install and reports a cost of 80 cents per square foot of ceiling, including insulation for ceiling and side walls.

In one building project resistance heating, with blowers, is being installed. In this development several homes have already been completed and 35 are under construction. Plans now call for a total of 200 homes in the project.

There will be a 7.2 kw of connected load in each of these homes. Walls and ceilings will be insulated with fiber glass. Homes will be completely equipped with storm windows and doors. Volume of each home will be 6,720 cu ft.

Heating will be individually controlled in each room. Units consist of a galvanized metal duct mounted in the wall and extending from a few inches above the base board to a few inches below the ceiling. The duct terminates at each end in a grille to the room. Heat, forced by the blower, comes out at the lower grille. Air from the ceiling area is drawn into the top grille by the fan, passes down over the heating element and out to the room again at floor level.

One advantage of this scheme is its flexibility. The unit is designed so that the heating element can be changed easily to take care of any possible error in calculating heating requirements. This eliminates the tendency to oversize the heating installation which leads to unnecessarily high demands on the power system and to less even heat in the homes.

Indianapolis Power & Light Co plans to install primary metering on the project to gain information on demands, diversity and revenues that may be expected from this type of load.

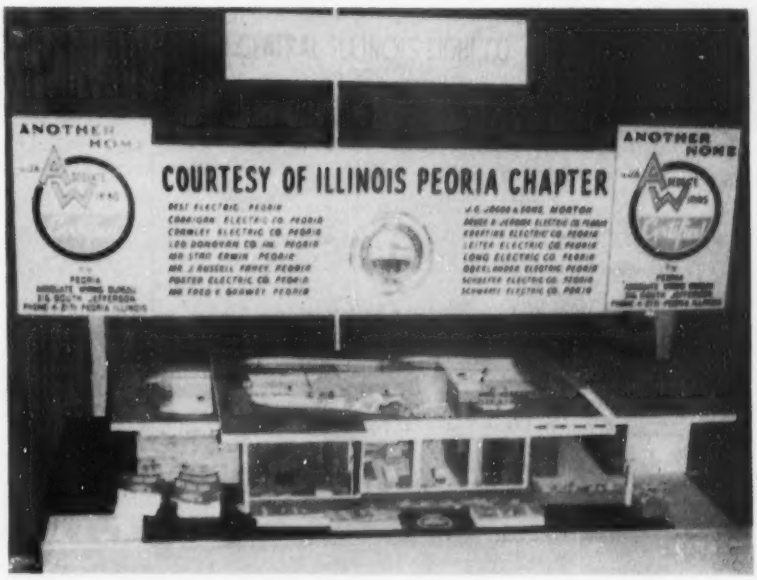
Miniature Home Demonstrates Adequate Wiring

Taking "Electrical Living" as its theme and concentrating on adequate wiring and seeing the home in a better light, Central Illinois Light Co staged a display at the Greater Peoria Home Show recently that proved to be one of the best attractions to the more than 30,000 persons who attended. Featured in the exhibit was a miniature all-electric home which was adequately wired and in which a day's activities were dramatized, one by one, through illumination of the electrical appliances and lighting equipment.

This model home is built to scale, one inch to the foot. Even the furniture in the home is built to this scale. The home is complete, including even a color television set. It was built originally for the NECA convention held at Washington, D. C., and shown later at the Home Economics convention at Atlantic City. It cost $5,000 and was built by two Peoria electrical contractors, Lyle Foster and Elmer Krefting. It was loaned by the National Electrical Contractors Association to the local Adequate Wiring Bureau.

The top of the home has a transparent cut-away plastic section so that the interior is visible to those looking down upon it. The arrangement takes the form of a tour through the house, starting at parking the car in the garage. The garage door opens and the lights go on. From there on, the doors of the various rooms open and both the general lighting lights and those for each appliance go on in sequence as the person travels from room to room in a pathway of light. It takes four minutes to make the complete cycle which then starts over again.

Home lighting was promoted in an adjoining display, "Seeing Your Home in a New Light." This consisted of a panel floor display 8 by 8 ft. The panel was in full color and showed lighting recipes, with novel animation which told in a few seconds the story of home light conditioning. Four company employees were present at all times to explain the exhibits.



setting the pace of transformer design for the industry

New LX-T arrester has 300% greater "dynamic" current rating

The new LX-T lightning arrester for Westinghouse "CSP®" distribution transformers is an excellent example of the progress which has been made with expulsion arresters to keep pace with distribution system requirements.

You can install Westinghouse "CSP" transformers at any point on your distribution system. This includes—up close to a substation where dynamic current is high or at the end of your rural lines where it is low. The LX-T arrester has large surge current capacity and at the same time has exceptionally high, 60-cycle current limiting ability.

Greater current limiting action gives the LX-T the highest short-circuit rating of any expulsion arrester (20,000 amperes at 3 kv, 12,000 amperes at 9 kv). A unique arc-spiraling action which stretches out the path of 60-cycle current is the big reason. If power current does flow, the unique arc-spiraling action effectively limits the flow to a very small magnitude and to a small fraction of a half cycle. Current limiting action is so effective that it *prevents any* flow of power current in at least half of all operations.

The new arrester is ruggedly mounted directly to the wall of the "CSP" transformer where it provides maximum coordination with high-voltage bushings and transformer insulation level. It is available in 3-kv, 6-kv and 9-kv ratings.

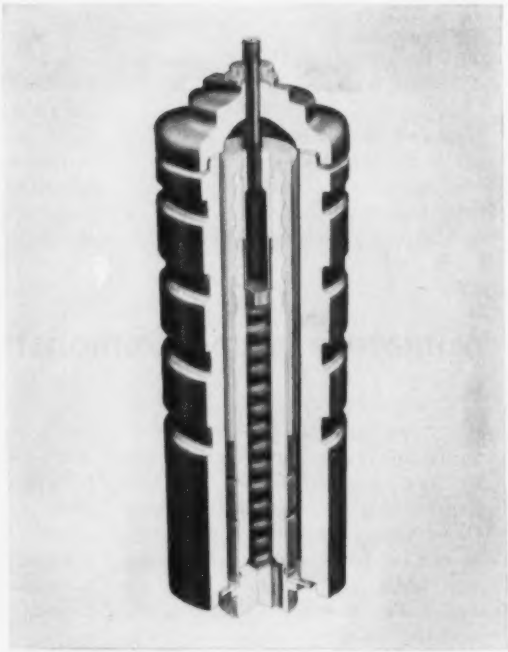
This latest development is just one of many arrester advances made since the first expulsion arrester was introduced by Westinghouse in 1932. Since then, excellent performance of 2,575,000 transformer arresters representing 18,000,000 "arrester years" has proved the effectiveness of the Westinghouse De-ion® arrester. The LX-T design has already been proved through 3 years of successful field experience with the LX distribution arrester.

For further details call in your nearby Westinghouse representative or write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

J-70731

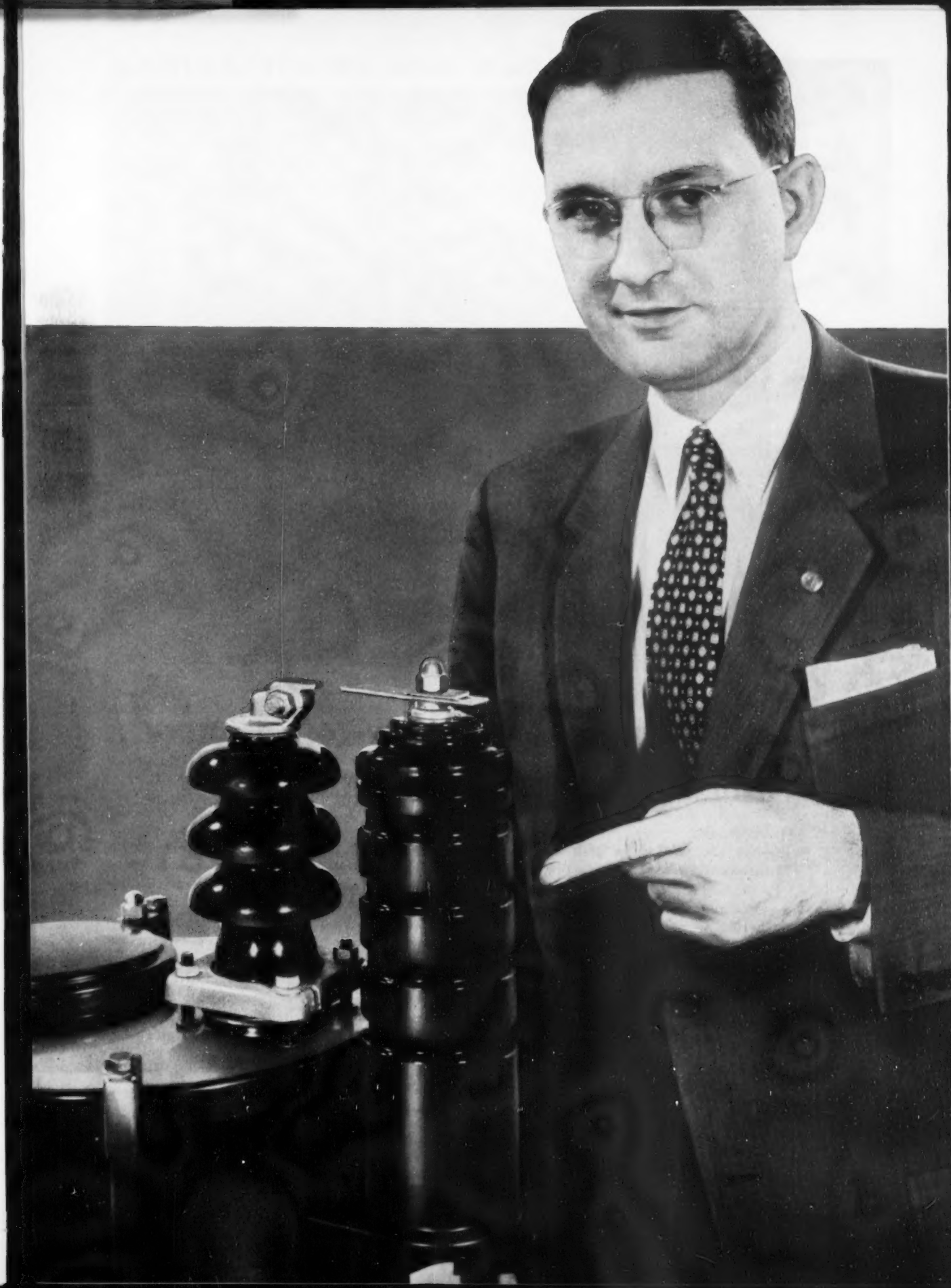
YOU CAN BE SURE...IF IT'S

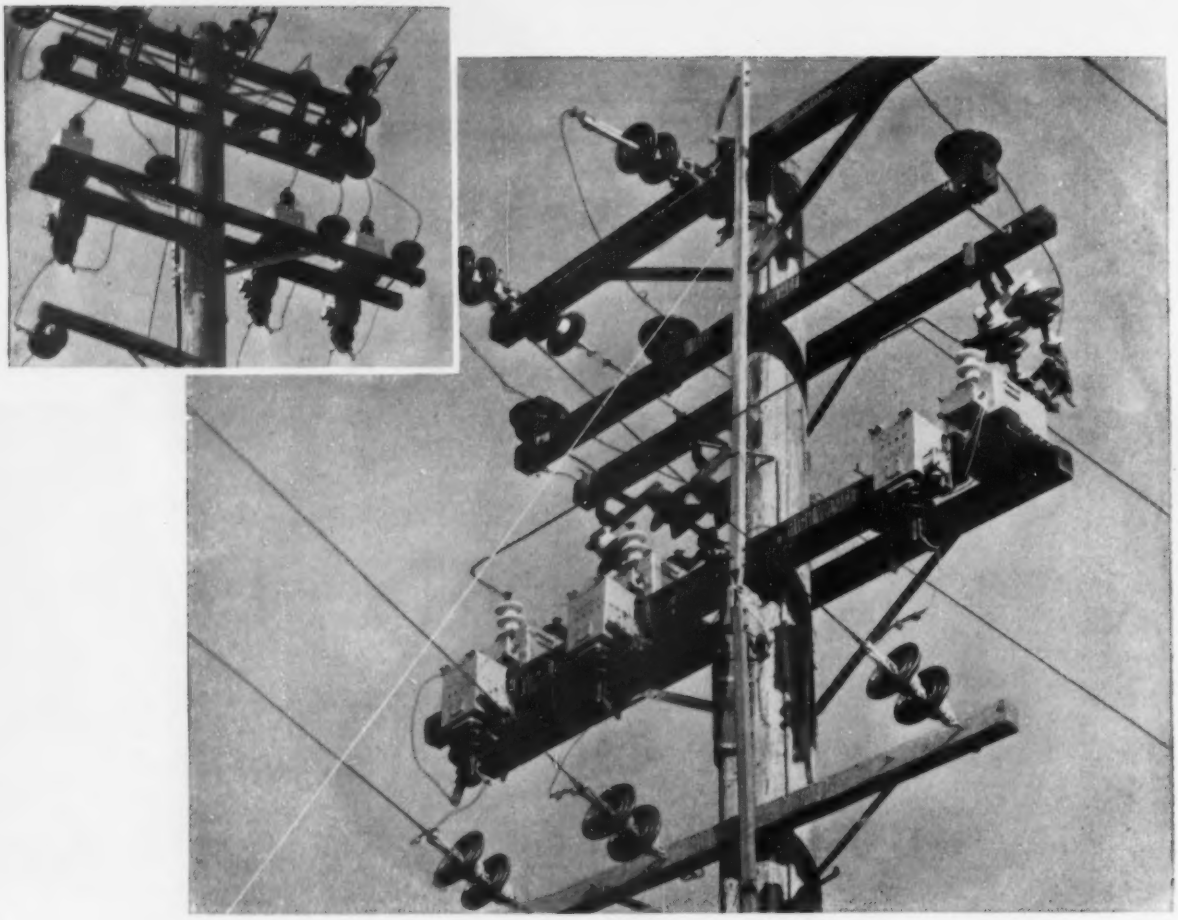
Westinghouse



The cutaway LX-T shown, illustrates the spiral filler which stretches out the path of 60-cycle current and limits it in both magnitude and duration.

The top-series gap permits the arrester to be isolated from the line voltage except when operating. The spark-over of the LX-T is well below the BIL of the transformer it protects.





They got pole-top neatness...low-cost accuracy... with Westinghouse Transformers!

Above are two views of a Westinghouse Instrument Transformer installation on the Pacific Gas & Electric Company system.

Because they're compact and light, for easy handling in any installation, the mounting problem was simplified. Top, bottom and side mounting positions adapt readily to awkward, close locations. Top-mounted, high-voltage bushings simplify connections. For these reasons, Westinghouse Transformers naturally lend themselves to neatness.

Accurate, reliable measurement results from Westinghouse Instrument Transformers through such design features as plastic impregnation and Hipersil® steel cores. These features keep maintenance at a minimum.

Because he handles the most complete line of instrument transformers in the industry, your Westinghouse representative may be helpful in answering your problems. Call him today, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-70666

YOU CAN BE SURE...IF IT'S Westinghouse

CONSTRUCTION was officially completed this month at Westinghouse Electric Corp's new $45-million appliance plant at Columbus, Ohio. New plant, which contains about 2 million sq ft of floor space, is slated eventually to manufacture about 4,000 major appliances daily

$45-Million Appliance Plant . . .

. . . at Columbus, Ohio, is completed by Westinghouse Electric Corp. Factory's refrigerator production put at 800 daily

Westinghouse Electric Corp has announced the official completion of construction of its new $45-million appliance plant at Columbus, Ohio, largest the corporation has built.

The one-story plant, fourth to be operated by the firm's Electric Appliance Division, will be used entirely for the production of major appliances, having a production capacity of approximately 4,000 a day.

800 Refrigerators Daily . . . The new plant is now producing about 800 refrigerators daily. As more refrigeration production is moved from the Mansfield, Ohio, plant, output will be increased until the Columbus plant is eventually producing all Westinghouse refrigerators and freezers. The plant, slated to be in 100% operation by the end of this year, at present is operated by 1,500 employees. It will eventually employ about six or seven thousand persons.

Located on a 315-acre site just outside the city of Columbus in Franklin Township, the new addition contains over two million sq ft of working area. Almost half-a-mile in length, the factory building has four manufacturing aisles, each 200 ft wide and approximately 1,500 ft long. These aisles lead in a straight-line production pattern to the warehouse area which has a storage capacity of 100,000 major appliances. The two-story office building, which has a marble and stone entrance, extends from the plant in a T pattern.

John Ashbaugh, vice president of Westinghouse, said the company has larger plants, but this is the largest Westinghouse has ever built.

Cites Industry Stability . . . Speaking at a press conference held in the new plant, Ashbaugh said, "Our continued investment in these plants (appliance factories at Columbus and Mansfield, Ohio, and Springfield, Mass.) is an expression of our faith in the economic stability of the electric appliance industry and of the nation throughout 1954 and into the future."

Refined Copper Stocks Increase in February

Stocks of refined copper held in the United States by members of the Copper Institute, Inc, at the end of February amounted to 118,417 tons, an increase of 10,296 tons above the 108,121 tons held on Jan. 31.

During February deliveries to domestic fabricators increased to 87,384 tons compared with deliveries of 77,091 in January. Refined production, however, dropped to 103,496 tons from 111,553.

Outside the United States refined stocks totaled 275,372 tons on Feb. 28, a decrease of 5,138 tons from 280,510 tons on Jan. 31. February deliveries also dropped to 76,001 tons from 91,941 tons in January and refined production was 70,772 tons compared with 85,100.

To Survey Dam Site

Kaiser Aluminum & Chemical Corp has announced it will start preliminary field surveys soon for a possible water storage dam site on the Columbia River in British Columbia, Can. Company hopes to provide its own water supply, releasable during low water periods, for production of power for its aluminum operations in Spokane and Tacoma, Wash. Storage site in B. C. is the Arrow Lakes, which an Army Corps of Engineers report says could provide as much as 9-million acre ft of storage.

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Gould-National Batteries	9	Jan.	$1,841,962	$2,052,173	$5.07	$5.75
			1953	1952	1953	1952
Aluminum Co of America	12	Dec.	48,848,094	43,527,142	$4.71	$4.19(a)
General Cable	12	Dec.	5,095,416	5,283,230	2.29	2.38
Holophane	6	Dec.	343,656	322,711	.91	.85
Ingersoll-Rand	12	Dec.	21,626,987	20,392,563	10.69	10.08

Notes—(a) Adjusted to reflect two-to-one stock split in April, 1953.

Ruckus at UE Schenectady Office

James J. Matles (right) national organization director of United Electrical Workers (Ind.), and Michael Jiminez, UE international representative, are repelled by guards at UE Local 301 headquarters at Schenectady, N. Y. The local, which is trying to bolt the left-wing UE and affiliate with the CIO, was holding a session at which the barred UE chiefs were finally admitted and permitted to address members. UE local represents 20,000 GE workers there.

Members of the local have approved a proposal to secede and affiliate with the International Union of Electrical Workers, CIO. Switch of Local 301's 20,000 members, employed by General Electric Co, would reduce UE's strength in GE plants throughout the country to about 30,000. The shift would boost IUE's forces in the company's system to about 100,000.

MANUFACTURING BRIEFS

Production of primary aluminum in the United States during January totaled 232,493,207 lb, the Aluminum Association has reported. January production topped December, 1953, output by 11,910,219 lb.

Lapp Insulator Co, Inc, has started construction on a new high voltage laboratory at its Le Roy, N. Y., plant which will be known as the John Lapp High Voltage Laboratory. The new laboratory is named in honor of John S. Lapp, who founded the company in 1916 and until his death last spring was active in its management. When completed in July, the lab will have facilities for 60-cycle testing at over 1 million v and impulse testing at 2.5 million v. There also will be facilities for high current testing.

SALES ASSIGNMENTS

COMPANY STAFFS

Ansonia Wire & Cable Co, Ansonia, Conn., has appointed John L. Marsh as its sales representative covering New York, Massachusetts, and Rhode Island. Marsh, who has had 12 years experience in the cable business, will make his headquarters at 400 E. 56th St., New York.

National Electric Products Corp has named Edgar M. Perrott as sales manager for a newly organized Wisconsin territory, with offices in Milwaukee.

MEETINGS CALENDAR

***Edison Electric Institute**
Power Station Chemistry Subcommittee of Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, March 29-30; 20th Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Hotel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; Conference of Public Utility Fleet Operators, Sponsored Jointly by EEI Transportation Committee and AGA Automotive-Mobile Equipment Committee, Mount Royal Hotel, Montreal, Que., April 20-23; Prime Movers Committee, Electrical Equipment Committee, and EEI-AEIC Meter and Service Committees, May 3-4; Hydraulic Power and Transmission-Distribution Committees, May 4-5, All at Edgewater Beach Hotel, Chicago; 22nd Annual Convention, Atlantic City, N. J., June 1-4; Accident Prevention Committee, Mark Hopkins Hotel, San Francisco, July 1-3.

Northwest Public Power Association
Annual Convention, Winthrop Hotel, Tacoma, Wash., March 31-April 1-2; Engineering and Operation Section, Benjamin Franklin Hotel, Seattle, Wash., May 20-21.

Electrical Industry Show
Sponsored by Electrical Maintenance Engineers Association of Southern California, Shrine Exposition Hall, Los Angeles, April 1-3.

American Institute of Electrical Engineers
6th Conference of Subcommittee on Rubber-Plastics Industries of Committee on General Industry Applications, Mayflower Hotel, Akron, Ohio, April 5-6; Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J., April 22-23; Northeastern District Meeting, Hotel Van Curler, Schenectady, N. Y., May 5-7; Conference on Telemetering, Morrison Hotel, Chicago, May 24-26; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25; Committee on Petroleum, Conference on Electrical Applications in Petroleum Industry, Mayo Hotel, Tulsa, Okla., Sept. 28-29.

Maryland Utilities Association
Spring Conference, Lord Baltimore Hotel, Baltimore, April 23.

***National Association of Electric Companies**
Annual Meeting, Mayflower Hotel, Washington, D. C., April 29.

Pennsylvania Electric Association
Systems Operation Committee, Bedford Springs Hotel, Bedford Springs, Pa., May 6-7; Prime Movers Committee, Castleton Hotel, New Castleton, Pa., May 17-18.

Southeastern Electric Exchange
Spring Meeting, Engineering and Operation Section, Sans Souci Hotel, Miami Beach, Fla., May 6-7.

American Society of Mechanical Engineers
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24; Fall Meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 8-10.

World Power Conference
Sectional Meeting, Rio de Janeiro, Brazil, July 25-Aug. 10.

Pan-American Federation of Engineering Societies
(UPADI), Third Convention, Sao Paulo, Brazil, Aug. 2-12.

*Addition this week.

See Sylvania's Complete Line of

J-H1 . . . color-corrected lamp coated on inside with special phosphor that provides a pleasing "Golden White" light.

E-H1 . . . ideal lamp for "high bay" interior, or outdoor lighting. Rated at 400 watts, delivers 20,000 lumens.

C-H5 . . . a smaller size of the E-H1 type, for general industrial applications. 250 watts, 11,000 lumens.

IMPROVED MERCURY VAPOR LAMPS!

A-H1 . . . popular, low-cost mercury lamp rated at 400 watts, 15,000 lumens output.

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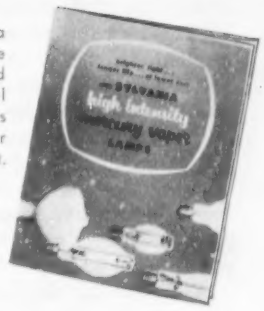
For higher lighting intensities and big lighting savings, many industries today are looking to Sylvania's improved Mercury Vapor Lamps.

These lamps offer several times the life of ordinary incandescent bulbs. And, they give double the light output for the same wattage. As a result, you can use fewer lamps and fewer fixtures. Save on power, installation and maintenance costs, too.

New, long-lasting Sylvania Mercury Vapor Lamps are now available in types and sizes for every industrial need. Illustrated folder gives full information. For your copy just drop a line to Dept. 4L-2809, Sylvania.



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LIGHTING · RADIO · ELECTRONICS · TELEVISION

Earnings Should Cover Costs . . .

. . . New York PSC is told by New York Telephone Co's R. H. MacMillan in hearing on utility's rate increase application

In testifying as to New York Telephone Co's earnings, R. H. MacMillan, vice president and controller, said: "Earnings should be sufficient to cover costs, if any, incurred in rendering service but not accounted for as such under the prescribed accounting system. I have in mind particularly the item of economic depreciation." This testimony was given recently before the New York Public Service Commission on the company's application for a rate increase.

Fair Return Concept . . . In the hearings he made the following significant comment which synthesized the concept of fair return: "As a corollary to these considerations, since investors whose funds are not already committed have a free choice as to the particular company or industry in which they will invest, a regulatory judgment of the earnings necessary to afford ability to attract capital on terms which deal equitably with committed investors entails consideration of the appropriate relationship—with due allowance for differences in risk—between the earnings of the particular utility under consideration and other enterprises whose earnings . . . (have similar risk characteristics) . . ." [parenthesis supplied].

The following question was put to the telephone executive:

Q. "You have not yet discussed the last of the three basic considerations in the measurement of reasonable earnings, which you listed at the beginning of your testimony. Will you please do so now?"

A. "That last consideration (i. e. economic depreciation) [parenthesis supplied] had to do with the fact that earnings should be sufficient to cover costs, if any, which are not accounted for as such. Thus, this element is in a somewhat different category from the concepts I have been discussing up to this point. It concerns factors which do not involve earnings at all, in the economic sense, even though amounts allowed to meet such costs may be reported as earnings under the accounting convention employed . . . "

Cost Recovery . . . As to the recovery of **all costs** of doing business, MacMillan said: "Under present day conditions there is a large item of economic cost which is not recorded anywhere in the company's books of account but which is nonetheless a real cost of providing service. Since conventional accounting and our own Uniform System of Accounts do not provide for its inclusion in expenses, it must be recovered as a component of what is earnings, in the accounting terminology. This element of economic cost is the excess of economic depreciation over depreciation charges under conventional accounting procedures."

In discussing the problem of economic depreciation in more specific terms, MacMillan said: "The concept of economic depreciation does not quarrel with this objective (i. e. the equitable distribution of cost in time) [parenthesis supplied]. It quarrels rather with the measurement of that cost which must be given consideration in the economic sense, if not in the accounting sense. Since public utility rate regulation is fundamentally **an economic activity, it must take economic depreciation into account**" [emphasis supplied].

MacMillan continued: "If the economic depreciation rather than the book depreciation is not taken into account in the price setting process, then the prices established do not meet the true cost of furnishing service and the business is not sustaining itself . . . Fundamentally, the purpose of depreciation is not to provide for replacement but to provide for an equitable distribution of cost. Neither does economic depreciation, as I have measured it, call for a guess or estimate of future changes in the price level. It deals only with current levels for the purpose of measuring one element of cost in dollars of the same size as the revenue dollars required to meet that cost." When asked what the significance was of the understatement of economic costs, MacMillan said: "If rate making is based on book depreciation without allowance for the additional cost of economic depreciation, the result is that the subscriber pays less than the full cost of furnishing service to him."

An attempt to give a dollar value to economic depreciation was objected to as being "incompetent, irrelevant and immaterial" by John T. Ryan, special counsel of the PSC. Objection was sustained by Commissioner Spencer B. Eddy. However, counsel for the company, Henry J. Friendly, read this into the record by saying, "I offer to prove by this witness, if he were permitted to answer the question to which you sustained the objection, he would state that economic depreciation for 1954, determined on the basis of value studies, would be approximately $90,569,000."

MacMillan subsequently stated that "The book amount based on average telephone plant in service as estimated will total $68,613,000."

To the question by Commissioner Eddy as to "How should the amount by which economic depreciation be dealt with in the commission's rate determination, in your opinion?", the witness answered, "It should, in my opinion, be allowed as a component of earnings, over and above the amount of earnings necessary to meet the expectations on the basis of which capital is attracted, **and to deal fairly with past investors**" [emphasis supplied].

As to the adequacy of earnings, taking into account economic depreciation as well as the possibilities of alternate investment in leading manufacturing enterprises, MacMillan said, "I believe that the 8.7% rate is lower than a rate which would meet the test of being commensurate. A truly commensurate rate would surely be above 8.7% **and perhaps above 9.7%** [emphasis supplied]. Note that the latter figure is not far from the end result which I developed on a capital attraction basis. However, I do not consider it necessary to refine the range further because 8.7% is already considerably above the rate of earnings which the company will realize if its request for higher rates in this proceeding is granted."

Pacific P&L's 20,000th Stockholder

Pacific Power & Light Co greeted its 20,000th stockholder, Mr. and Mrs. Colin Maxwell of Portland, Ore., at a luncheon of company executives recently. The company, which attained independent status just four years ago, now has stockholders in every state, with more than 50% living in the western half of the country. As a memento of the occasion, Pacific P&L's Pres Paul B. McKee (above right) presented the Maxwells with an inscribed full-color photograph of the 125,000-kw Yale plant, company's latest hydro development. The new stockholders also toured operations carried on at the Pacific P&L's headquarters building in Portland.

PUD Hopes to Finance Rocky Reach in 2 Years

The Chelan County PUD of Wenatchee, Wash., hopes to be in a position within two years to begin financing of a proposed $225 million hydroelectric dam on the Columbia River at Rocky Reach, according to Manager Kirby Billingsley.

Before the PUD can arrange financing, however, three other events must occur.

First, Congress would have to approve a bill, introduced by Rep Walt Horan of Wenatchee, which would authorize the project, appropriate planning funds, permit the Army Corps of Engineers to build the dam if the PUD desires, and provide for marketing by the Bonneville Power Administration of power not required locally. The PUD is hopeful bill will pass at current session of Congress.

Second, the Corps would have to determine feasibility of the project, as specified in the bill.

Third, the PUD would have to agree with the Department of Interior on a contract for the surplus power from the 585,000-kw project.

These steps completed, the PUD proposes then to begin the issuance of bonds to finance the project.

Proposes Ban on Listing 'Charity' as Expense Item

Do charity contributions constitute legitimate operating expenses? A legislative proposal introduced in the Michigan legislature by Rep Joseph J. Kowalski (D-Detroit) would outlaw contributions from expenses figuring in connection with utility rate increases.

"When charity is considered an operating expense, the utilities are using it to get rate increases from the state," Kowalski said. He maintains the contributions should be deducted from profits.

Specific criticism was leveled at Michigan Bell Telephone Co for listing $180,000 in contributions as an operating expense in its request for a $22.8 million rate increase.

Kowalski said he will introduce his ban against "charity expenses" in an amendment to a bill he has already introduced. That one would permit the Public Service Commission to deny rate hikes for telephone companies which do not meet service standards.

MSP, Pacific P&L Merger Favored by Stockholders

Stockholders of Mountain States Power Co and Pacific Power & Light Co favor merger of the Pacific Northwest companies by a large majority. Vote of MSP equity holders at Albany, Ore., and a canvass of the proxies of Pacific P&L shareholders at Augusta, Maine, were announced recently by the presidents of the two utilities.

Final action by Pacific's shareholders has been deferred until April 30 to comply with Maine laws governing filing dates for final papers involved in completion of necessary federal and state regulatory body hearings.

The special MSP stockholder meeting resulted in representation by 88.4% of the outstanding shares and 99.7% of the voting favored the merger, according to MSP Pres A. W. Trimble. The tabulation of proxies from 17,700 individual Pacific P&L shareholders represented at Augusta showed 99.5% of the shares in favor, according to Pres Paul B. McKee. The proxies represented 90.6% of the outstanding shares.

Merger was proposed by directors of both companies Jan. 13 on the basis of nine shares of PP&L common for ten of Mountain States and the preferred on the basis of one for two.

Renews Attack On Oregon Law Taxing PUD Property

Northern Wasco County (Ore.) PUD has filed an amendment complaint with the County Circuit Court attacking validity of the Oregon law of 1939 providing for taxation of public

utility districts. Defendants are Wasco County, the Oregon Tax Commission, city of The Dalles, Oregon Business and Tax Research, and six individuals.

The amendment is part of legal action that began last September, in which the PUD asked for declaratory judgment ruling the 1939 law illegal and the PUD therefore not liable for property taxes Wasco County seeks. The PUD has asked a temporary injunction to prevent the county from collecting $23,410 in taxes for the years 1950-53 which the county claims are delinquent. The city subsequently levied on property valuation set by Wasco county assessor. The tax research organization entered the case as an intervenor on the side of the county, indicating a prospect of the case reaching the state supreme court.

FINANCIAL BRIEFS

Puget Sound Power & Light Co counsel has appealed to Massachusetts Supreme Court against the March 9 order of Suffolk Superior Court requiring Puget to permit examination of its stockholders list by shareholders seeking proxies to promote merger of the company with Washington Water Power Co. Examination was refused by Puget on advice of counsel. Unless case is heard by May the annual meeting of the company is likely to be postponed until the fall.

Southwestern Public Service Co has placed privately with 11 insurance companies $12 million first mortgage 3.65% bonds due in 1984 . . . **Newport Electric Corp** is planning to sell $2.8 million first mortgage 4% bonds due in 1984 to the Rhode Island Hospital Trust Co.

Washington Wire . . . Senate Finance Committee is ready to begin hearings on a House-passed tax revision bill, providing $1.4 billion in relief by a thorough revision and streamlining of the tax code. Among other changes designed to remove "inequities" in the tax laws, the House bill provides for some relief from so-called "double taxation" of dividends and also for faster write-off of depreciation on property and machinery. Senate action on tax revision is expected to follow in two or three weeks of committee hearings, with final action during the latter part of April.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1954									
Mar 18	**2.82**	**2.84**	**3.15**	**3.90**	**4.11**	**4.44**	**4.79**	**5.17**	**5.43**
Mar. 11	2.82	2.84	3.14	3.90	4.08	4.42	4.79	5.20	5.41
END OF QTR.									
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50

Data: Reis & Chandler, Inc.

EARNINGS

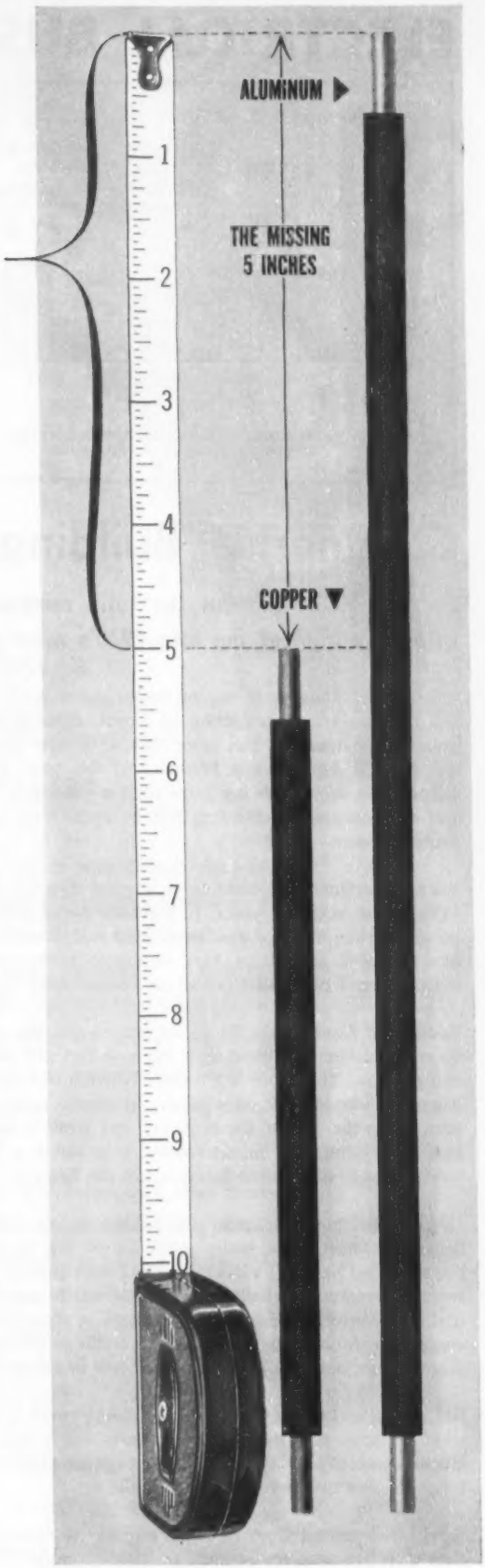
Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Arizona Public Service	12	Jan.	$3,886,000	$3,354,000	$....	$....
			1953	**1952**	**1953**	**1952**
California Oregon Power	12	Dec.	$2,700,997	$2,617,258	$1.76	$1.69
California-Pacific Utilities	12	Dec.	595,101	538,153	2.11(a)	2.02(a)
Cleveland Electric Illuminating	12	Dec.	14,765,329	12,669,557	4.07(b)	4.13(b)
Commonwealth Edison	12	Dec.	37,402,994	33,463,970	2.38	2.25
Kansas Power & Light	12	Dec.	4,417,307	4,546,650	1.32(c)	1.42(c)
Middle South Utilities, consolidated	12	Dec.	14,134,000	12,398,000	1.98(e)	1.86(e)
Pennsylvania Power & Light	12	Dec.	16,868,147	17,840,848	2.94(g)	2.45(g)
Philadelphia Electric, consolidated	12	Dec.	29,779,238	27,330,322	2.36	2.20
Public Service Electric & Gas	12	Dec.	25,562,807	23,599,583	1.99(f)	2.02(f)

Notes—Figures shown for the last nine companies have been audited; (a) Based on average number of shares outstanding during the respective years; (b) Based on 3,342,308 shares in 1953 and 2,789,476 shares in 1952; (c) Based on 2,572,833 shares; (e) Based on 7,125,000 shares in 1953 and 6,650,000 shares in 1952; (f) Based on 8,386,178 shares in 1953 and 7,221,945 shares in 1952, and (g) Based on shares outstanding at year end.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF MARCH 18-24			
Bonds			
Detroit Edison—1st mtg 2¾% due 1984	$40,000	99.25%	2.91%
Preferred Stocks			
Louisiana Power & Light—70,000 sh 4.16% $100 par	$7,000	$102.21	4.07%
Dallas Power & Light—70,000 sh 4% no par	7,000	102.56	3.90
Rochester Gas & Electric—50,000 sh 4.10% $100 par	5,000	100.50	4.08
Common Stocks			
Utah Power & Light—200,000 sh	$7,490	$37.45	5.34%
Southern Indiana Gas & Electric—114,166 sh (being offered commonholders on a 1-for-7 basis, record Mar. 24 to expire April 2)	2,883	25.25	5.94
SCHEDULE FOR MARCH—APRIL			
Bonds and Debentures			**Bid Date**
Pacific Power & Light—1st mtg due 1984	$8,000	.....	Mar. 29
San Diego Gas & Electric—1st mtg due 1984	17,000	.....	Mar. 30
Georgia Power—1st mtg due 1984	11,000	.....	April 6
Community Public Service—1st mtg due 1984	3,000	.....	April 6
Loup River Public Power District—Series D revenues	10,000	.....	April 6
Loup River Public Power District—Series F revenues	7,600	.....	April 6
Central Power & Light—1st mtg due 1984	18,000	.....	April 12
Southern Indiana Gas & Electric—1st mtg due 1984	8,000	.....	April 13
Ohio Power—1st mtg	20,000	.....	April 14
Los Angeles Department of Water & Power—electric plant revenues due 1955-84	15,000	.....	April 14
West Penn Power—1st mtg due 1984	12,000	.....	April 20
Preferred Stock			
West Texas Utilities—60,000 sh cum $100 par (holders of $6 preferred will get opportunity to exchange present stock for new stock on the basis of the offering price of new stock and $110 call price on $6 stock, difference to be adjusted by a cash payment)	$6,000	.....	April 8
Ohio Power—50,000 sh $100 par	5,000	.....	April 14
Northern States Power (Minn.)—150,000 sh $100 par	15,000	.....	April 20
Arkansas Power & Light—70,000 sh $100 par	7,000	.....	April 20
Common Stock			
Pennsylvania Power & Light—704,917 shares (to be offered commonholders on a 1-for-7 basis, record April 2 to expire April 19)	.....	.....	.....
Texas Utilities—250,000 sh	.....	.....	April 13
Northern States Power (Minn.)—1,219,856 sh (to be offered commonholders on 1-for-10 basis, record April 15 to expire May 4)	.....	.....	April 14
Public Service Co of New Mexico—138,551 shares (to be offered commonholders on 1-for-10 basis, record April 1)	.....	.....	.....
General Public Utilities—about 607,000 sh (to be offered commonholders on a 1-for-15 basis, record about May 15 to expire June 2)	.....	.....	.....

Get these missing 5 inches and save thousands of dollars a year!



As THE figures below show, $.02705 buys only 7 inches of #6 solid copper TBWP.

But for the same money you can get 12 inches of #4 solid Kaiser Aluminum PE or Neo.—*a full five inches more!* That, of course, means simply this:

(1) With Kaiser Aluminum conductor, you can build far *more* line for the same amount of money!

(2) Or you can build the same amount of line for far *less money!*

Either way, the savings add up to thousands of dollars a year!

Use the box below to estimate your savings. Then let Kaiser Aluminum help you convert to aluminum easily, efficiently, economically—as hundreds of power companies are doing! Complete field, engineering, and laboratory services available at no obligation. Contact any Kaiser Aluminum office in principal cities, or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Estimate your savings with these Kaiser Aluminum Conductors:

	Per 1000 Ft. lbs.	Cost
#6 Solid Copper TBWP*	112	$ 46.73
#4 Solid Alum PE (2/64)	48	27.05
#4 Solid Alum Neo (4/64)	64	27.05
#2 7 Strand Copper TBWP*	270	111.70
1/0 7 Strand Alum PE (4/64)	141	71.05
1/0 7 Strand Alum Neo (4/64)	172	71.05
2/0 7 Strand Copper TBWP*	522	204.99
4/0 7 Strand Alum PE (4/64)	261	138.50
4/0 7 Strand Alum Neo (4/64)	306	138.50
4/0 7 Strand Copper TBWP*	800	312.56
336400 CM, 19 Str. Alum PE (4/64)	388	216.80
336400 CM, 19 Str. Alum Neo (5/64)	469	232.75

1/1/54 prices based on 30,000#—F.O.B. Destination. *URC Copper Triple Braid Weatherproof.

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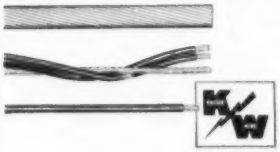

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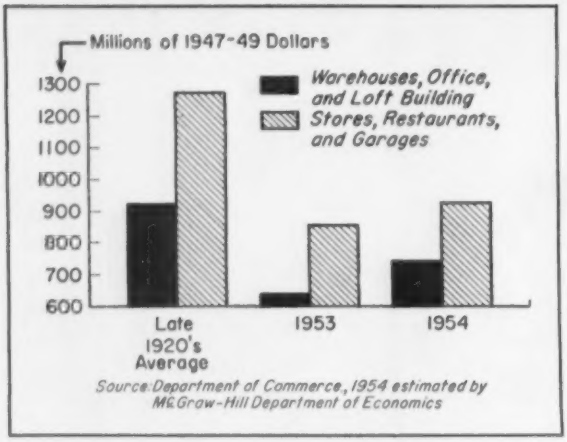
ELECTRICAL BUSINESS OUTLOOK



Source: Department of Commerce, 1954 estimated by McGraw-Hill Department of Economics

Commercial Building . . .

. . . is increasing but the total remains far below the high of the late 1920's average

Commercial building is one of the brightest spots in the economy today. Construction of stores, office buildings, and similar structures ran more than 45% over the year-ago level in January and February of this year. It's not expected to show such big gains for the year as a whole. But total commercial building will be up at least 10%—probably more—in 1954.

Booming commercial building is a good sign for power sales in the next few years. It promises faster growth in power consumption for the "small light and power" group of customers, who have been dropping farther behind industrial and residential power consumers since the war.

Boom Will Continue in '54 . . . Furthermore, the current boom in commercial building is likely to last well past the end of 1954. The boom is a natural reaction to long years when volume of work on commercial structures was low, even when the rest of the economy was growing rapidly. (See chart comparing recent volume with booming 1920's—with effects of inflation taken out of the figures).

Office building in particular fell behind in the past two decades. Offices were badly overbuilt in the optimistic twenties, and yawning vacancies, along with general economic depression, cut building in the thirties to practically nothing. Wartime and postwar shortages of materials and equipment, followed by material and credit restrictions of Korean war, helped keep office work low in recent years.

But now it looks as if a real office building boom is under way. It started in Pittsburgh, New York, and a few other cities—especially in Texas—but most major cities and a lot of smaller towns are getting into the act.

It will take several years of boom building to make much of a dent in vacancies—which are down around 1% for first-class space in some areas. And the recent movement for major redevelopment programs in large cities—often helped by municipal, state and federal money—will help keep the boom going.

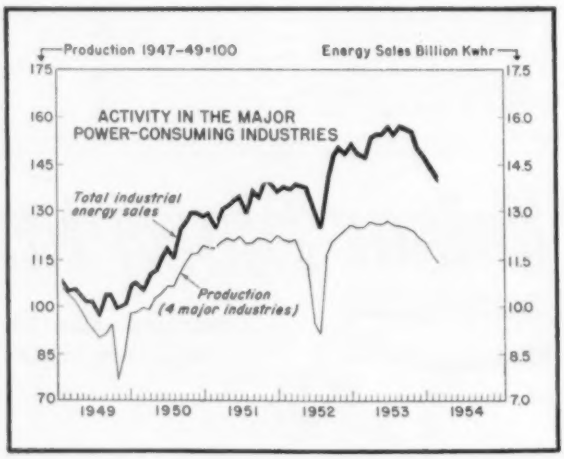
Store construction, the other major form of commercial building, has not been held back so severely in recent years. There was a lot of store building right after the war. But shortages and restrictions cut volume in 1951 and 1952. Even last year, with most restrictions off, work on new stores, restaurants and garages was only about two-thirds as much as in the peak years of the 1920's—although the economy as a whole has grown by more than 100% since the twenties. So, there is obviously room for more growth.

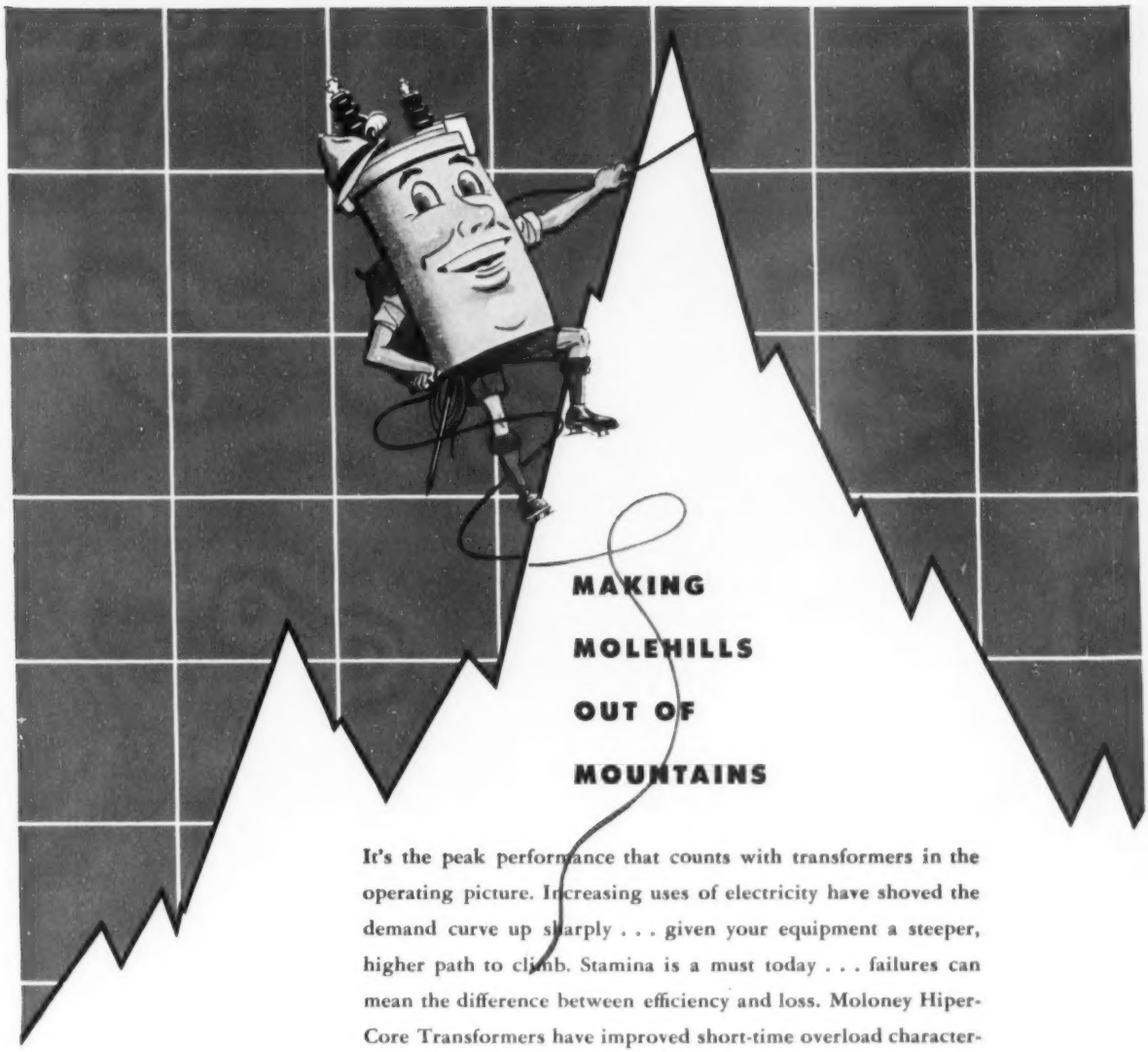
Suburban Population Involved . . . Another reason for further growth in store construction is the trend toward great expansion of the suburban population. Population in suburban areas grew about 2½ times as fast as total population between 1940 and 1950, and it's still growing fast. (EBO, Mar. 2 1953).

Other non-residential building—aside from industrial—has been at fairly high levels in recent postwar years. Work on these religious, recreational, hospital, and similar facilities is expected to continue at high levels for at least the next several years.

Greater commercial building obviously implies faster growth in commercial power use—especially since the new structures will be better lighted than older buildings, and many of them will be air conditioned.

New office buildings are usually air conditioned, well lighted and generally comfortable. They will be grabbing the prize tenants—despite higher rents—unless the older buildings add better lighting and perhaps air conditioning, too. Downtown stores in the big cities will have to modernize in similar fashion if they want to hold some of their customers who now live in the suburbs near new shopping centers. And modernization means more power consumption.





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5/8% STEP VOLTAGE REGULATORS

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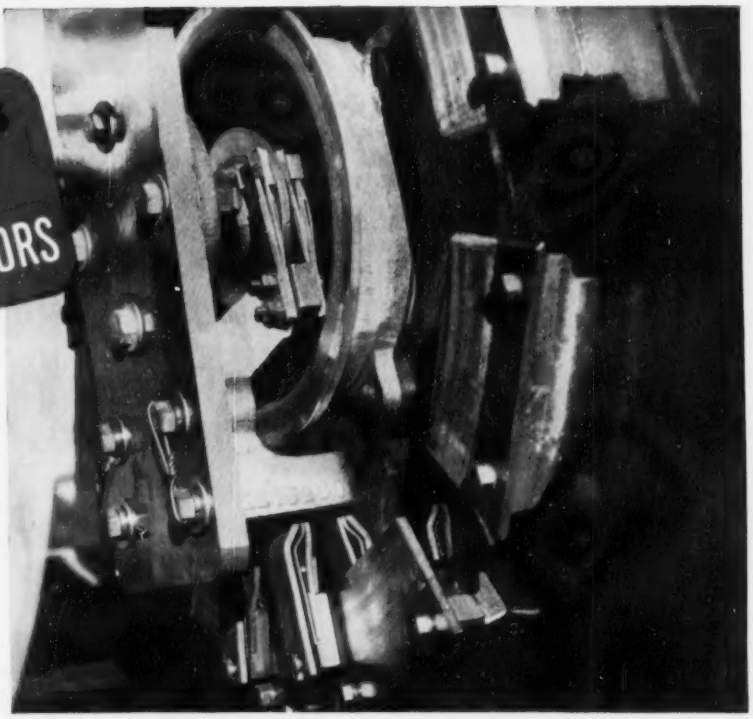

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The unretouched photo above shows the condition of the tap changer from an Allis-Chalmers power regulator that has changed taps 1,240,000 times on a western utility.

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Next time you consider regulation, for new or replacement installations, it will pay to get the complete facts about Allis-Chalmers regulators. Contact your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more details.

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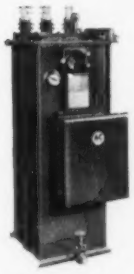
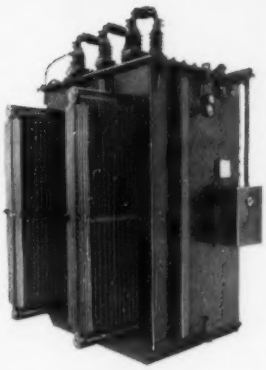


Single-Phase Power Regulator



Three-Phase Power Regulator

Single-Phase Distribution Regulator

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